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VOLUME XX

NUMBER 1

JULY 1954

PUBLISHED BY THE SOCIETY
FOR AMERICAN ARCHAEOLOGY

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American Antiquity is published by the SOCIETY FOR AMERICAN ARCHAEOLOGY during the months of January, April, July, and October. Subscription is by membership; annual dues are $6.00, of which $5.00 is for a subscription to *American Antiquity* and other publications as issued.

American Antiquity is printed by the University of Utah Press, University of Utah, Salt Lake City 1, Utah.

Entered as second-class matter June 1, 1951, at the post office at Salt Lake City, Utah, under the Act of March 3, 1879.

Proposed articles and contributions to "Facts and Comments" should be submitted to the Editor. Reviews and publications for review should be submitted to the Associate Editor. Information for "Notes and News" should be sent to the appropriate Assistant Editor or to the Associate Editor.

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AMERICAN ANTIQUITY

VOL. XX JULY, 1954 No. 1

TRADE GOODS RESEARCH TECHNIQUES

KENNETH E. KIDD

THE PAST DECADE has witnessed a phenomenal development of historical archaeology in America; concomitantly, there is an upsurge of interest in the European artifacts found on the sites which have been excavated. On sites which were exclusively European in occupancy, these goods had served domestic purposes only; on Indian sites, they represented the new needs of the aborigines, the policies of colonial administration, and numerous other facts which it is not necessary to detail here. These European artifacts, and particularly the ones found on sites occupied by Indians, have aroused the interest of archaeologists, partly for their own sake, and partly because they seem to offer a new means of dating. It is with the last-named possibility that this article is concerned.

Indian sites of historic vintage frequently yield European artifacts, especially along the coastal areas. Many of these villages, however, are otherwise unknown to history. If some means of accurately dating them could be devised, they would at least be assignable to some specific period. If this were done, it is conceivable that future identification would be possible, which might have interesting results for the ethnologist, archaeologist and the historian. The European goods might possibly hold the much-sought for answer. The belief that this may be true is based upon the concept that these artifacts, like virtually all others with which we are acquainted, have undergone an evolutionary change through time and space, involving constituent materials, form, size, color and other attributes. If these changes can be determined categorically and dated absolutely, then they can be utilized directly in establishing a chronology by means of which the Indian sites where such specimens are found can be dated.

The problem is not as simple as it looks. At the present time only the sketchiest information is available as to the changes which we postulate as having occurred. To begin with, we are dealing for the most part with the simplest of everyday things, such as glass beads, iron axes, hoes, awls and kaolin pipes. A few categories, like guns, are better known and something of their evolutionary development was recorded. But by and large we have to do with simple things which no one thought of writing about, which never caught the eye of the artist-recorder, and which passed unnoticed in the commerce of the time. No catalogues of such things exist; there are almost no drawings or descriptions of them. In such a state of affairs, where shall we turn for help? How shall we proceed to analyze them?

It is not my intention to review such techniques as proper note-taking, collation, photography and others with which we assume every student to be familiar, but rather those (1) which archaeologists as distinct from historians may not know, and (2) which are peculiar to this specific investigation. Each student's area of research will vary, and for the present each will of necessity select a larger or smaller area, within which he will have to concentrate his efforts. Inasmuch as the tools available will vary somewhat from region to region, as will the problems, my aim is only to suggest certain general principles which I have found useful, and which can be modified to suit local needs and the requirements of various stages in the research itself.

The first thing that any investigator will have to do, no matter in what area he is working, or to what time-span he has chosen to limit himself, is to familiarize himself with the physical remains—i.e., the specimens—available. They are basic to all later deductions and conclusions. The technique is familiar to everyone for it simply involves a careful examination of all available specimens, whether they are in museums or in private collections. While examining these remains, every effort should be made to obtain complete documentation upon them, both by verbal enquiries and by a careful examination of the archaeological literature.

However exhaustive and satisfactory this may be, the student must not overlook the fact that the European artifacts he has been examining from an Indian site differ little if at all from contemporary specimens in use by the whites themselves. It frequently happens that the two sets of goods may be found side by side, as for instance in Indian sites in Virginia in the early 17th century and at Jamestown, or at Kicotan; or again at Aptuxcet and contemporary Indian villages in Massachusetts. Sometimes it is possible by this simple comparison to date specimens from Indian sites, although this is rare indeed. We usually have to look much farther afield. The first and most logical place to look would be in the folk museums of Europe where the simple arts and crafts of the people have been preserved. There are over 900 museums in France alone, the greater portion of which are in this category, and most of which are totally unknown in America. The only way in which the material in them can be examined is by a personal visit and even this frequently calls for much diplomacy, patience and skill.

In any event, the information we are seeking will seldom be found in the famous and larger museums. Visits to the Louvre, the Victoria and Albert Museum and similar places will, of course, inform us as to stylistic trends throughout the ages, but the examples shown will usually be from the higher arts and seldom, if ever, directly useful to us. Such places as Blaise Castle House Museum in Bristol, the Geoffrey Museum and the Guildhall in London, and the Cluny Museum in Paris will be rewarding. In America itself, small collections of everyday things from the Colonial period exist, but usually they are not very informative, nor directly useful, consisting for the most part of furniture. However, one will find collections of spoons, buckles and so forth in the Royal Ontario Museum at Toronto, the New-York Historical Society Collections and in the Museum of the City of New York, the Philadelphia Art Museum and elsewhere, and in the United States National Museum there are good collections of early ceramics. By and large, however, it is to the small local museums of England and Europe that we must turn if we wish to find direct comparisons for our excavated material, and even then the quest is arduous.

A very great deal of practical knowledge can be gained by such direct comparisons of excavated and documented specimens. It is perhaps the most satisfactory method of meeting the situation. But unfortunately it will not entirely solve our problems. There is bound to be required a whole store of knowledge concerned with the manufacture, distribution and circulation of our material. There is a great body of literature concerned with stylistic trends, with which all students should be familiar; and several other aspects of the problem could be mentioned. Then, on the purely historical side, a researcher in the field of trade goods should have a thorough knowledge of the progress of settlement in America, involving not only when and where settlements were made, but where the settlers came from, what their living conditions were in the Old Country, the records of their dealings with the aborigines and a host of kindred matters. Official documents both in America and on the other side of the Atlantic are vitally important in tracing the progress of trade and intercourse with the Indians. Many of these are essential in placing, approximately or positively, the location of aboriginal sites, and sometimes in dating them. In short, the researcher in this field cannot be too well equipped in knowledge of the political, economic, social and stylistic history of the Renaissance in Western Europe.

The techniques of historical research are highly developed and complex, requiring much time and experience for their mastery. Consequently, to the archaeologist, they are a thing apart and he cannot rightly be expected to be fully familiar with their use. If, however, he envisages employing historical facts in the elucidation of his problems, there are certain procedures which he must master, such as the various classifications of guides, and the use of historical bibliographies. A few of those which I have found especially necessary may be mentioned here.

If the beginner in this field will set aside a few weeks or months for the purpose of bibliographic research, he will save himself much labor and many disappointments. References should be culled on such matters as local archaeology, local history, American colonial history, the economic and social history of Europe in the 16th-18th centuries, the histories of guilds and local industries, art histories, folk customs, travel accounts, diaries, and above

all, on manuscript collections. A brief word on some of them may be helpful.

No satisfactory bibliographies of archaeological literature exist. The best coverage is perhaps to be found in the annual bibliographies in the *Journal de la Société des Américanistes de Paris* (1895 to date); and a systematic search through the files in *American Antiquity* will add considerably to the list. Rouse and Goggin's (1947) *An Anthropological Bibliography of the Eastern Seaboard*, F. H. Douglas' (1934) *Guide to Articles on American Indians in serial publications* and Murdock's (1953) *Ethnographic Bibliography of North America* are among the best available. Use should also be made of G. L. Gomme's (1907) *Index of Archaeological Papers, 1665-1890* and of Davis and Taylor's (1938) *Guide to Periodicals and Bibliographies Dealing with Geography, Archaeology and History.*

Turning from the very meager resources for archaeological bibliography, we will encounter much more encouraging results in the field of history. By contrast, we are confronted with a plethora of material, and the problem is to reduce it to manageable proportions. Consulting a book like E. M. Coulter's (1935) *Historical Bibliographies, a Systematic and Annotated Guide*, will do much to clear the path. For American exploration and history, one of the first lists to come to mind is that in Justin Winsor's 1889 *Narrative and Critical History* but it is very much out of date. More useful to the present-day student, but also much more exhausting to use is G. G. Griffin's (1906-1948) *Writings on American History.* It is extraordinarily complete, listing Canadian publications as well as those from the United States, has archaeological entries and is otherwise eminently satisfactory. It is, in fact, essential but its great bulk makes its analysis a slow job. Another useful guide is Beer's (1938) *Bibliographies in American History.*

Armed with such references, the student should be able to obtain not only the wide perspective of American history that he will need, but also be able to prepare special bibliographies of his own, especially for areas and periods. One such will be a bibliography of Indians. Several fairly adequate ones already exist, such as Field's (1873) *Indian Bibliography* and Stevens' (1870) *Rare Americana* but they are greatly out of date and often inaccurate, so that it is better to prepare one's own. Some students will no doubt be attracted to the fur trade, because in its records can often be seen the account of what passed in the way of presents and in payment between whites and Indians. From the earliest times, active trade was carried on with the natives—beads, knives, and other artifacts being given in exchange for furs. In the east, the records are often spotty, or even lacking; the farther west one goes, by and large, the more satisfactory they become. Generally speaking, the literature of the fur trade has not been well worked up; much remains to be done. A few references will be found, however, in Moloney's (1931) *The Fur Trade in New England* which can well be used as a starting point for further investigation.

Still other students will be attracted to the official documents relating to the Indians, for in them it is often possible to find long lists of presents given by colonial administrations to the natives in order to secure their loyalty or their favor. Again, there is no special bibliography, but a search of state histories and archives will reveal much of this nature. There is indeed enough material in this field alone to sustain a long-term project.

Correlative to the study of the lists of presents or trading goods are the civil inventories. These are very abundant in the East, even from the earliest times, and provide us with details as to tools, household goods, clothing and other requisites in use by the colonists. Since these often differed in no way from those which got into Indian hands, they are useful in giving a picture of the state of affairs at any given time. Dow's (1935) *Everyday Life in Massachusetts Bay Colony* is an excellent example in this category.

The next question to arise in one's mind is "Where did these goods originate?" Did the axes come from England, and if so, from what town? Did the beads come from Venice, France, Holland or elsewhere? We know, for instance, that glass had been made in France from very early times, and that Usselinx, who was one of the men behind the South Company, established a glass works in Sweden. Did some of the beads come from there? Where were the brass and copper goods made? The clay pipes? The tomahawks? Finding where they were made is not merely an academic question; it is fundamental to knowing *when* they were made and how to date them. In this regard a search of town and county histories

will be rewarding. There is a great abundance of these for England, and presumably also for France, Holland, and other Continental countries, although I have had little success in finding the latter here. Perhaps the best single source for England is the series known as *The Victoria County Histories*, of which there is one for almost every county, brought out or at least initiated in honor of Queen Victoria's diamond jubilee. These give a wealth of information on the economic development of the areas they treat, indicating the rise of various industries, mentioning their products and sometimes even indicating where the products were marketed. Besides the county histories, the publications of the national and local archaeological societies will often be found helpful, especially in discussing special finds, such as ruined glasshouses. To some extent, the guild histories will be useful also, but for the most part, in my experience, they are concerned chiefly with the legal history, the attempts to control the workers, the markets, and so on. Before leaving the discussion of economic history, I should like to emphasize the importance of being conversant with its major outlines for each country and for each century; a competent student will be able to run down the sources in specialized fields which are most likely to be helpful to him with a minimum of effort. Handy references in this connection are the two publications by J. B. Williams entitled *A Guide to the Printed Materials for English Social and Economic History, 1750-1850*.

One cannot have too intimate an acquaintance with his field; the more he is immersed in its social, political and economic life, the better he can understand it and interpret it to others. To this end, diaries and newspapers are of inestimable value. Not only do they re-create for us the atmosphere in which the transactions occurred, but they frequently reveal to us the transactions themselves. Diaries of settlers, for instance, often give firsthand accounts of treaties or other business with Indians, and enter into details of the goods exchanged, the prices received and other intimate matters. One of the best known of these is Father Potier's *Livre de Compte de la Mission des Hurons du Detroit, 1735-51*, and numerous others could be cited. Anyone wishing to investigate such sources is referred to William Matthews' (1945) *American Diaries*. Matthews (1950) has also published a bibliography of British diaries between 1442 and 1942 which is useful to those who need to familiarize themselves with the English scene. I have no suggestions for continental diaries but doubtless they exist in quantity also.

Journals and newspapers have naturally a longer history in England than in America. Even before newspapers in our meaning of the word existed, there were irregular publications of the sort which carried some current news, and there were also the "learned society" publications, like the Transactions of the Royal Society which regularly reported scientific news. I feel that these sources may contain much of importance for American archaeology if someone had the courage to attack them vigorously. This, I think, is especially true of the Royal Society, the Journal des Savants (1665-1684), Le Mercure Galant (1672-1820), the Gazette de Leyde (1680-1814) and other continental publications. E. Hatin's (1866) *Bibliographie Historique et Critique de la Presse Périodique Française* . . . is the best bibliography for the French press, while Clarence Brigham's (1947) *History and Bibliography of American Newspapers, 1690-1820* is the most complete for the United States. (The finest repository for American newspapers is the American Antiquarian Society in Worcester, with the Library of Congress next.) While the American publications are relatively late, (they did not begin to appear in quantity before 1730) it should repay someone to analyze them systematically.

Everyday matters have a way of eluding history and so it has been with regard to local trades and industries. We can read hundreds of histories of England and emerge not much the wiser as to where brass wire (from which the Indians liked to make spirals for their ears) was made. Such things often struck the fancy of foreign travelers, however, who noted them in the books they wrote later on returning home. Hence these foreign travel books of the period are sometimes helpful. Fussell's (1935) *The Exploration of England* is the best guide to such reading.

Without minimizing the value of the other aspects of trade goods research, great emphasis must be placed upon that which has to do with manuscript material. It has been my experience that so far as the records of transactions with the natives are concerned, it is of

first importance. Traders' accounts, treaties involving "presents" and the evidence of regulated trade are still nearly all in this form, and whoever desires firsthand information on this all-important phase must have recourse to it. A few suggestions as to how it may be utilized may be acceptable.

First of all, there is the vast body of official papers, for the most part to be found in the great national archives of England, France, Holland, Sweden, Italy and Spain. Insofar as such papers relate to America, they have been efficiently catalogued, in catalogues published by the Carnegie Institution of Washington. Anyone wishing to utilize the archives must have recourse first to these indispensable publications, in order to find his way around. I need mention only a couple here by way of explanation: C. M. Andrews' (1912-14) *Guide to Materials for American History, to 1783, in the Public Record Office of Great Britain*, and W. Leland's (1932, 1943) *Guide to Materials for American History in the Libraries and Archives of Paris*. The others are of equal importance, depending upon the area and era under study. They give a fair, but not a detailed picture of the various resources, but the mass is so great that this is all that can reasonably be expected. In conjunction with them, various published material can be used, such as Sainsbury's (1860-1953) *Colonial State Papers* . . . which give synopses of the originals. But far more valuable to us, generally speaking, are the manuscripts themselves. As for the European collections, they are, by and large, inaccessible to us unless we go to Europe to consult them. And if one does so, a careful scrutiny of the "Guides" will cut down greatly on time and expense. Fortunately, very considerable blocks of these manuscripts have been copied at various times, either in longhand, by photostat or in microfilm and can now be seen on this side of the Atlantic. The Library of Congress has a large collection of both English and French transcripts. Griffin (1946) does not list the French transcripts but is indispensable for the English. The Dominion Public Archives in Ottawa, however, has by all means the most complete collection of French transcripts pertaining to America and is in the process of publishing summary guides.

(It is probably worthy of note here that the U.S. Archives contains little of interest to us, since its collections pertain almost wholly to the post-Revolutionary era.)

Aside from the State papers, there are tremendous resources scattered all over the continent. State Archives should always be consulted early in the search; the Massachusetts State Archives, for instance, is a treasure house whose holdings have not been published or even calendared. New York State Library has manuscripts of prime importance, some of them as yet little known. In the case of certain states, as for instance Delaware, New Jersey and Pennsylvania, the records are for the most part available in published form. Also, state and private historical societies usually have hoards of documents of great value, much of it unpublished. The Massachusetts and Pennsylvania Historical Societies contain collections which no student in the field can safely overlook; the former, for instance, owns Parkman's manuscripts, and the latter has many transcripts from the Swedish Royal Archives, and the Public Record Office of England, not to mention extremely important traders' accounts.

Numerous other manuscript collections exist in America, though they are sometimes hard to locate. One need only mention, for instance, the Dominion Public Archives of Canada, the various provincial archives, and the many sectarian archives in the Province of Quebec, some of which contain essential material, not only for the northwest but also for the Mississippi Valley and for the far West, and which, for the most part, is little known. Then one should also cite the National Archives in Mexico City, which has a large and important collection. Nearer home, there are hundreds of small societies with manuscript holdings. During the era of the W.P.A. a great deal was done toward systematizing and compiling guides to these, most of which can be located under the headings "Historical Records Survey Guides." One should also mention such items as M. R. Cusick's (1932) *List of Business Manuscripts in Baker Library*, Greene and Morris' (1929) *Guide to the Principal Sources for Early American History in the City of New York*; E. Ring's (1938, 1939, 1941) excellent *A Reference List to Manuscripts Relating to the History of Maine*, A. E. Smith's (1944) *Guide to Manuscripts in the Wisconsin Historical Society*, and last but not least, Billington's (1951) *Notes and Documents: Guides to American History Manuscript Collections in Libraries of the*

United States. With these various signposts to guide one, it should not be impossible to isolate the material one needs from the private, county, state and national collections.

For the sake of something like completeness, it should be observed that certain other categories of printed and manuscript sources frequently repay investigation. Religious bodies, like the Society of Friends in Philadelphia, the Society for the Promotion of the Gospel, and numerous others have considerable manuscript holdings of great value; and there are, in fact, bibliographies of manuscripts in the hands of religious societies in this country and of ecclesiastical records for certain states, e.g., for New York.

I have stressed rather heavily the need for documentary research, having found from experience how important it is. It is true that the vastness of the record makes the searching of it a tremendous task, yet there is no other way of seeing the actual record of the transactions between the Indians and the whites, giving the commodities—and their prices—which passed between them during the centuries. Such concrete evidence brings us to grips with our problem; gives us a base for further operations and supplies the essential orientation. Then, having prepared lists of the material which actually passed in trade, we can proceed to track down the sources from which it came in the Old World through letter books and similar clues, until the manufactories themselves have been located. Documentary sources also give us our bearings in the New World for, upon diligent search, they will yield clues as to the dates of introduction of new types of goods, as for instance, silver ornaments, as well as the location of towns or at least the tribes to which such goods were consigned.

When all the evidence is in — the historical as well as archaeological — the task of synthesis remains. Theoretically, this consists of collating the two, and from the collation working out a chronological typology. The success of the procedure will of course depend upon two factors; (a) the thoroughness with which the job is done, which in turn depends upon the time and resources available, and (b) the completeness of the original record. No amount of searching will bring to light data which has already perished, and in all too many cases, this may prove to be the case. On the other hand, we may confidently expect good results in the majority of categories, or enough at least to be useful in establishing archaeological chronologies.

With this hasty review of techniques at the disposal of the individual, a word may not be out of place concerning the wider conspectus, namely, the matter of co-ordination amongst specialists. Enough has been said to make it plain that the field of trade goods research is an extraordinarily broad one. It follows that no one student can possibly be competent in all its branches, and that, to achieve the best results a pooling of knowledge is necessary. This can be achieved, I think, on an informal basis, although there is much to be said for having a central clearinghouse. If the latter could be set up, specialization would no doubt be encouraged, and then we might reasonably expect to see specific data on such topics as ironware, brassware, ceramics, glass, arms, jewelry, tobacco pipes, pewter and a host of other categories, pouring into the files, to be sifted and utilized by others. Furthermore, it would encourage existing specialists to contribute, and facilitate their cooperation. No archaeologist is likely to acquire the profound knowledge of arms, for example, as one who has made it a lifetime study, and his help should be sought. Likewise, there is need of a central file of illustrations, not only of archaeological material, but of documented specimens in historical museums and other places, which can be used in comparative work. The acquisition of such a collection, even for a single category of goods, is usually too costly for one individual to complete, but the individual might be willing to contribute duplicate prints of the small number that he would ordinarily take and thus make them available to the larger group. Again, such a clearinghouse could possibly undertake the building of a bibliography of literature bearing directly or indirectly upon the subject of trade goods; it is obvious that the existence of a file of this nature would save much duplication of effort on the part of individual students. Finally, at the very least, archaeologists engaged in working on historic sites should be encouraged to keep in touch with one another in order to keep abreast of progress and to cut down the time lag in the dissemination of information.

CONCLUSIONS

Current interest in historical archaeology in the Americas, and particularly in Canada and the United States, has given a new significance to materials of European origin found on New World sites, the possibility of utilizing them as dating tools being especially important. This latter aspect has stimulated many archaeologists to investigate the origins of such materials, and the present paper is a contribution in that direction. Research of this nature calls for a systematic collation of excavated material from America with documented specimens, which in the nature of things are to be found with maximum facility in Western Europe. Collateral to this direct research and supplementary to it is the search of the complex and vast mass of background material, whose importance cannot be stressed too highly. This includes (1) the political, social and economic histories of the fatherland countries of Western Europe between the time of the discovery of America and the end of the colonial period; (2) the histories of the colonies concerned; (3) the histories of the specific industries in which the student is interested and (4) the history of the distribution of products of those industries amongst the Indians and others in America.

The search will include the investigation of (1) collections of artifacts in museums and private hands both in America and abroad; (2) printed sources in libraries and other depositories; (3) manuscript sources in archives in the Old and the New Worlds, including in its scope material on trade, treaties, diaries, travel and allied topics.

Each student must perforce carry on his own research in his chosen phase of the work, but his efforts will be aided, and the study as a whole advanced, by the co-operation of students, not only in a given area of investigation but on a much broader scale designed to embrace trade goods in their entirety. A free interchange of information between students in archaeology, and between archaeologists and specialists in other fields (e.g., glass), based upon their most recent work, will be mutually advantageous. A central clearinghouse would have its advantages, as providing, for instance, accommodation for a master bibliography and photographic file; its main function should be directed toward cutting down on unnecessary duplication of effort, and toward assisting the students to find references and available material quickly and easily. In conclusion, it may be remarked that if current interest in trade goods is sustained there is good reason to hope that the next decade will see substantial progress and valuable results.

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Royal Museum of Ontario
Toronto, Canada
August, 1953.

TRADITION TREND IN CERAMIC DEVELOPMENT

GORDON R. WILLEY

A RECENT PAPER by Sears (1952) calls attention to an overall time trend in the design changes of various complicated stamped pottery styles in the southeastern United States. His analysis raises the question as to whether certain principles implied might not have more general application for the understanding of historical phenomena.

A number of years ago I ventured a definition of what seemed to be a kind of entity in the history of aboriginal Peruvian ceramics. This was termed a "pottery tradition." The concept was an attempt to comprehend a number of distinct pottery styles, occurring in different localities and at different time periods, as a single historical unit and is expressed (Willey, 1945, p. 53) as:

> . . . a pottery tradition . . . includes broad descriptive categories of ceramic decoration which undoubtedly have value in expressing historical relationships. . . . The pottery tradition lacks the specific quality of the localized pottery style . . . (It) comprises a line, or a number of lines, of pottery development through time within the confines of a certain technique or decorative constant.

Sears' article deals with what is, in effect, a pottery tradition. He is concerned with the continuity of complicated stamped wares in the south Appalachian province, the region of the state of Georgia and adjacent portions of bordering states. The predominance of complicated stamped pottery in this part of the United States has long been noted (Holmes, 1903), and the longevity of complicated stamping as a decorative technique has been plotted throughout the Georgia archaeological sequences (Fairbanks, 1950; Wauchope, 1950). Sears' contribution beyond this point is in synthesizing the particular developmental trends which this south Appalachian pottery tradition has followed through time. These trends, which lasted from "about 500 A.D. until 1750 A.D.," [1] can be summarized as a movement from complex to simple design elements, a simplification of the total stamp, a decreasing use of filler and clearer stamps, and a greater symmetry of design (Sears, 1952, p. 108, Fig. 52). These gradual shifts can be traced through the curvilinear early and late Swift Creek, Kolomoki, lines, an appearance of larger, more deeply cut Savannah, and Lamar styles in southern Georgia and north Florida; and they have parallels in the northern Georgia sequence of the Napier, Woodstock, and Etowah rectilinear styles. In other words, all of the complicated stamped ceramic styles of the south Appalachian region, which characterize the various periods of the different localities, can be harmonized into this overall diachronic configuration.

There is little doubt that these trends or drifts in change of Georgia complicated stamped pottery are the result of historical forces. Sears states (1952, p. 108):

> The parallel development in the northern and southern parts of the province . . . must be due in large part to influence from the one area on the other, the sort of influence from the south which may have produced the regularized Napier diamonds from the earlier erratic Napier on the one hand, and the movement of peoples indicated by the Savannah-Wilbanks intrusion into the Etowah valley on the other.

Thus, uniformity of the drifts is not the result of independent ceramic evolutions but derives from diffusion and other intercommunications among the subregions of the Appalachian province and their various local culture sequences. In fact, these trends, as Sears (p. 107) notes elsewhere, are "means of placing new stamped types . . . in their proper temporal position." That synchronization of this order could be effected by the degree of shift in design motifs is clear proof that a south Appalachian complicated stamped pottery tradition exists as an historically integrated entity.

We can now ask the question: Do comparable time trends, such as those observed in the south Appalachian complicated stamped ware, demonstrate the historical validity of other possible pottery traditions? By "comparable trends" we do not mean the specific sequence of ceramic design shifts that obtains in the Georgia tradition but, rather, the presence of any uniformities in the time-change continuum which may link pottery chronologies of geographically contiguous regions.

[1] Sears (1952, p. 108.) These are relatively "short" estimated dates. Adjusted to radiocarbon dates for Ohio Hopewell, and assuming a Hopewell-Early Swift Creek contemporaneity, would pull them downward 500 to 800 years.

An example of trends in ceramic change which characterize another pottery tradition are those plotted by Ford in a recent monograph (Ford, 1952). In his matching of ceramic sequences from Gulf Coast Florida, the lower Mississippi Valley, and eastern Texas, Ford has presented the case for another major southeastern pottery tradition. This Gulf Coast-lower Mississippi tradition features the techniques of incision, rocker-stamping, and punctation. These techniques are expressed in many types, or styles, in the archaeological chronolgies throughout the regions under consideration. The most notable traditional trend in these Gulf Coast-lower Mississippi regions is summarized by Ford (1952, p. 381) as:

> . . . the strong tendency . . . for the confining of a large proportion of the decorations to the upper part of the vessel wall, leaving the greater part of the body surface plain.

That is, there is a design arrangement shift from an earlier overall coverage of the vessel to a later zoning or banding confined to the upper part of the pot. It will be seen that this trend is totally unrelated in content or direction to the trend of change in the south Appalachian complicated stamped pottery tradition. Each is an historical phenomenon peculiar to its own traditional media and region.[2]

It should be recognized, of course, that no one seriously disputes the historical integrity of either of these pottery traditions, the south Appalachian or the Gulf Coast-lower Mississippi. Both are close-knit entities. Their internal change trends are, in a sense, not needed to demonstrate the historical unity of each. Let us turn, then, to a situation where the lines of interrelationship among regions and subregions are less well agreed upon and where there is less *prima facie* evidence that all of the pottery developments have a closely integrated common history. The southwestern United States is a classic example. While there seems to be little disagreement that the three principal subareas of pottery characterization — Hohokam, Anasazi, and Mogollon — were interconnected, especially in their later periods, there is no singleness of opinion as to the degree of interrelationship. Although Martin and Rinaldo (1951, p. 223) have pointed out that elements of pottery design are found throughout much of the area, there is certainly no evidence that any single style — by the broadest definition of that term — was ever held uniformly over the southwest. A red-on-buff Hohokam tradition in vessel decoration stands in clear opposition to a black-on-white Anasazi tradition, but a southwestern-wide pottery tradition has been more difficult to demonstrate.

In examining the southwestern ceramic styles from the standpoint of overall trends in design changes certain facts seem significant. In the Hohokam sequences, Haury (Gladwin, et al., 1937, Figs. 111, 112) has synthesized changes in design layout and design elements from the Estrella through the Sacaton phases, a time range of several centuries during the first millennium A.D. These changes run from simple, bold, broad-lined designs to increasingly complex, fine-lined designs in which small repetitive elements and filler play a prominent part. Midway in the sequence, life forms appear in addition to geometric elements. This same time pattern is duplicated in the Anasazi pottery development although the styles are quite different from those of Hohokam. The bold, relatively simple designs of the La Plata, White Mound, and Kiatuthlanna phases of the Basketmaker III and Pueblo I stages are replaced by the finer-lined, more intricate designs of the Reserve, Tularosa, and Animas phases of the Pueblo II, III, and IV stages (see Haury, 1936, Fig. 6). A perusal of Martin, Quimby, and Collier, 1947, Figs. 18-19, 21-24, 31-33, 35-36, will illustrate these same trends in Anasazi pottery. Life forms are of less consequence in Anasazi painting; but they occur, and this is towards the close of the sequence. Mogollon black-on-white painting, which begins somewhat later than the two-color wares of Hohokam and Anasazi, parallels the latter half of the sequence trends just described. Life

[2] Chronological spans of south Appalachian and Gulf Coast-lower Mississippi traditions are approximately equivalent and contemporaneous. In Gulf Florida, a region of geographical overlap between the two traditions, there is a blending of the two streams of influence in the same ceramic products. Yet under these conditions the separate traditional trends are evident. Late Swift Creek Complicated Stamped and Kolomoki Complicated Stamped styles are responding to the south Appalachian trends in the largeness and simplicity of their designs, but they also show influence from the Gulf Coast-lower Mississippi traditional trend in that these designs are restricted to a band around the upper part of the vessel wall.

forms are a common feature of this development in its Three Circle and Mimbres phases.

From the foregoing it can be seen that we have in the southwestern area a drift in pottery design change whose broad configurations envelope the life histories of the numerous southwestern pottery types or styles. The three generally recognized southwestern pottery traditions, Anasazi, Mogollon, and Hohokam, are caught up within these configurations of change. By analogy with the internal drifts of the south Appalachian and Gulf Coast-lower Mississippi pottery traditions, such a phenomenon is a strong argument for a unified pottery tradition for the southwest as a whole.

Another example of tradition trend in ceramics is suggested in southern Peru and adjacent Bolivia. There are a number of well-known pottery styles in these regions, both coast and highland. For the most part, they are considered as distinct creations, and the sequences of highland and coast are not generally thought to be closely related in their early periods. Kroeber (1944, p. 31) has remarked upon this as follows:

> Both in shapes and in designs, pure Nazca and pure Tiahuanaco are utterly distinct, as well as geographically separate. But they do share certain features: a ware technologically excellent, a firm and polished texture, polychrome painting with from four to six colors, occasionally even more. They are the only Peruvian styles with this degree of polychromism — they or wares influenced by them; and as Nazca and Tiahuanaco influences receded, Peruvian pottery receded to fewer and less brilliant colors. . . . These resemblances can hardly be mere coincidences. In principle, they are much more likely to be the result of contact or diffusional influences. What these were is a problem awaiting solution. It is the more challenging because the two styles at their culminations are so different both in theme and in aesthetic treatment.

Yet all of these styles, in whatever region or period, share an emphasis on positively painted polychrome decoration. In this, south Peru-Bolivia stands apart from central or northern Peru where other decorative techniques (e.g., white-on-red painting, negative or resist-painting, incision, modeling) are given prominence. I have referred to this southern preference for multicolor painting before as the south-Peru-Bolivian polychrome painting tradition (Willey, 1945, p. 54; 1949, p. 193). On the south Peruvian coast, the archaeological sequences in the Nazca and Ica valleys begin with the Paracas style. Paracas has previously been thought of as two cultural periods, an earlier Paracas-Cavernas and a later Paracas-Necropolis (see Bennett, 1946, pp. 95-96; Bennett and Bird, 1949, p. 112). However, the recent work of W. D. Strong and his associates in the Nazca Valley indicates that the Paracas culture can best be conceived of as a single, pre-Nazca period (Strong, personal communications, 1952-53). In the Paracas polychrome wares, with which we are concerned, two, three, and four colors are used, and pigments are applied both before and after firing. The painted designs, which are usually bordered by incised lines, are divided between geometric and life forms (Kroeber, 1944, pls. 13-15; Bennett, 1946, pl. 20). Bold rectangular elements and stepped figures are common (Kroeber, 1944, pl. 15, *f*, *i*; 1953, pl. 27, *a*, pl. 28, *a*, *c*, *d*, pl. 29, *a*; Bennett and Bird, 1949, Fig. 29). In the succeeding early Nazca period, pottery polychrome painting is in numerous colors. Motifs of men, animals, and plants predominate, and curvilinear figures and elements are employed more frequently than in the Paracas style (Gayton and Kroeber, 1927, pls. 1-3). This is followed by a tendency in late Nazca for the polychrome designs to become smaller, for figures to be used repetitively, and for the total design area to be more cluttered or filled with small elements (Gayton and Kroeber, pls. 8-11).[3] The Tiahuanaco-influenced Nazca Y of the next period is marked by reduction and loss in life forms, by a continued trend in repetitive elements, and by fewer colors (Gayton and Kroeber, 1927, pls. 12-16). The final Middle and Late Ica styles record an extreme stylization and rigidity of life representations, increasing use of small geometric elements, and close-spaced repetitive arrangements (Gayton and Kroeber, 1927, pl. 18; Kroeber and Strong, 1924, pls. 31-38). In the south highlands of the Titicaca Basin, the early styles, such as the Pucara (Bennett, 1946, pl. 37) and Early Tiahuanaco (Bennett, 1934, Figs. 13-14; Bennett, 1946, pp. 112-114) are simple polychromes combining bold rectilinear geometric designs with both stylized and naturalistic human and

[3] This is based upon the Nazca A-Nazca B sequence propounded by Gayton and Kroeber.

animal figures.[4] Classic Tiahuanaco (Bennett, 1934, Figs. 15-16) is richer in color and life representations than the preceding styles. Although still a stiff, essentially rectilinear art, classic Tiahuanaco comes closer to naturalism and curvilinear lines than either its antecedent or derived styles in the south highlands. Decadent Tiahuanaco (Bennett, 1934, Fig. 17) shows color loss, reduction and extreme stylization of life forms, and repetitive design features. Up to this period, the Titicaca Basin ceramic trends have paralleled those of the south coast although being quite distinct stylistically; however, at this point, the two sequences can be closely co-ordinated by the diffusion of specific Tiahuanaco-like style influences. Post-Tiahuanaco pottery styles of the Titicaca Basin are not well known, but the Sillustani, Collao, and Allita Amaya painted wares (Tschopik, 1946, p. 52, Figs. 8-13, 20) suggest a further parallel to the late south coastal trend in their limited use of color, predominance of small geometric designs, and repetitive arrangements. Incaic pottery, of the final prehistoric period, has not been mentioned for either coast or highland. Its locus of development may have been to the north of the Titicaca Basin in the vicinity of Cuzco. In its small, repetitive geometric design it seems to fall in with the tradition trend of south Peru-Bolivia; however, it also introduces a strong theme of naturalism that suggests other traditional affiliations (see Kroeber and Strong, 1924, pl. 40; Tschopik, 1946, Figs. 14-19, 22-25). To recapitulate, the south Peru-Bolivian polychrome tradition trend, as exemplified on both coast and highland, began with the use of relatively few colors and a combination of bold geometric and life designs. Increased utilization of color and more naturalistic (curvilinear) designs followed. Naturalism then broke down through reduction and stylization, and colors became fewer. Repetitive geometric design emerged at the last.

It has been stated at the outset and throughout this discussion that the concept of trend or time-change pattern within a pottery tradition is a recognition of historical phenomena. By that it is meant that the processes of diffusion, trade, migration, and other forms of contact have been responsible for the uniform currents of modification which have swept along the diverse ceramic styles of a tradition. Before examining this hypothesis further, the question should be asked as to what other causal forces or conditions could have produced similar results. Two possibilities suggest themselves. The first of these is independent evolution. Could not the trends we have observed in the various regional or local sequences of any one of these pottery traditions be separate and historically unrelated developments? This is a legitimate question that deserves serious consideration. It is, for example, common knowledge that similar courses of development may be traced for ceramic technology in various parts of the world. In Peru and Mexico, to turn to a New World instance, the history of aboriginal pottery manufactures, insofar as we can now trace it, begins with a preponderance of plain and simply decorated wares and moves through an increasing complexity of form and design elaboration. It seems highly unlikely that these are closely interrelated historical trends or that the pottery developments of Mexico and Peru could be linked into a single tradition as the term is defined herein. Diffusional connections undoubtedly exist between the Andes and Meso-America, but such connections are almost certainly not of the same order of historical intimacy that is suggested for the pottery traditions under investigation. The tradition trends we have plotted are, inevitably, parts of some more all-embracing courses of development in New World ceramics, but each does not in itself recapitulate any greater pattern or law of change. The south Appalachian tradition, confined as it is to carved paddle stamping of pottery, undergoes a shift from intricate small, highly complex designs to larger, bolder, more simply presented designs. The southwestern pottery tradition, in its painting, moves in exactly the opposite direction, from large and bold to the small and intricate motifs. Life form elements are a late introduction into this tradition trend. The south Peru-Bolivian polychrome styles go from bold treatment of both geometric and life forms to naturalism and curvilinearity and then on to loss of naturalism and repetitive geometric decoration. In the Gulf Coast and lower Mis-

[4] Chiripa (Bennett and Bird, 1949, p. 147, fig. 27), which is believed to precede both Pucara and early Tiahuanaco, is a two-color ware which, apparently, antedates the beginnings of the polychrome tradition in the south highlands.

sissippi Valley incised, rocker-stamped, and punctated styles the content of the trend is entirely different from any of the other three. Change is in the direction of design placement and arrangement on the vessel. In view of these differences in the trends, and considering the geographical unity of each of the pottery traditions concerned, it seems unlikely that we are dealing with phenomena of independent pottery evolutions. The parallel configurations that exist among the component parts of any tradition are peculiar to it alone. They are not duplicated by the trends in the other traditions.

A second possible explanation for the trends is brought to mind by an analogy with the phenomenon which Sapir (1921) has designated as "linguistic drift." In Indo-European languages structural changes have been observed to follow a trend or drift in one direction. As Kroeber (1948, pp. 242-243) explains:

> . . . it can be traced in every Indo-European branch of which our historical record is long enough. Most of these languages have not been in contact with each other for the one to three thousand years that the change has been going on. Change by influence of one on the other, leading to imitation, is therefore excluded.

The causes of this drift are not fully understood, but, presumably diffusion and borrowing can be ruled out. Kroeber (1948) has speculated:

> Possibly the change . . . got under way early, in original Indo-European, before this stock had branched out into its daughter languages, and the impulse persisted in the latter in greater or less strength. This would make the process carry on by momentum from the past.

Fascinating as this idea is, it does not seem to be applicable to the pottery tradition trends. In the first place, language, as opposed to material culture, has greater limitations of choice, fewer possibilities for kinds or directions of structural change. Secondly, whereas it can be demonstrated that Indo-European languages were isolated from each other by great geographical distances during the long courses of their developments we know that the local and regional sequences of our pottery traditions were not so isolated one from the other.

We return, then, to our original assumption. The trends of change that characterize the pottery traditions of this discussion are the results of significant historical contacts throughout the time span or life of the tradition. This hypothesis is supported by the very close synchronization of change within any of these traditions. The diagrammatic charts which Sears, Haury, and Ford present make this period-for-period synchronization within the tradition strikingly clear. In Peru and Bolivia, Bennett's (Bennett and Bird, 1949, Fig. 19) chronological chart shows the south coast sequence to be slightly in advance of the south highland column in the earlier periods although closely synchronized with it in the later. The hypothesis of close and steady contact is further bolstered by examples of trade or stylistic interinfluencing within the geographical range of each pottery tradition. Sears (1952, p. 108) has mentioned specific examples of this between the southern and northern sequences of the south Appalachian complicated stamped tradition. Such contacts and movements are a major part of Ford's (1952, pp. 380 ff.) thesis on the pottery history of the Gulf Coast-lower Mississippi Valley. In the southwest, the apparent crossties among Hohokam, Mogollon, and Anasazi are more frequent in the later periods than the earlier; but early evidences of such contacts are known, and, moreover, such contacts are in pottery trade (Martin, Quimby, and Collier, 1947, pp. 115-117, 172, 177-178, 208). In Peru and Bolivia, there are widespread stylistic linkages between coast and highland on the Tiahuanaco horizon, and such close ties are duplicated again on the Inca horizon in the final prehistoric period. As in the southwest, the earlier periods seem more independent of each other; but there are certain elements and themes which relate even these early styles, such as the common use of the feline as a decorative motif.

To conclude, a tradition trend in ceramic development is a time-dimensional configuration which is expressed in pottery decorative or other pottery properties and which co-ordinates and interrelates the changes in the various sequences and styles of a specific pottery tradition. It is a phenomenon resulting from historical contacts whose evidences may, or may not, be readily perceived. It appears to be subject to certain limitations of geographically continuous space in the same manner as the pottery tradition.

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Peabody Museum
Harvard University
September, 1953

ATTRIBUTES AND THE DISCOVERY OF PROJECTILE POINT TYPES: WITH DATA FROM THE COLUMBIA-FRASER REGION*

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THE CLASSIFICATION of pottery types has apparently already reached a satisfactory degree of descriptive accuracy. Although problems remain, numerous site comparisons and important cultural connections have been based upon pottery. Classification of stone artifacts is not in so happy a state. Wheat has also recently called attention to this fact (1953, p. 196): "If cultures predominantly lithic in complexion are to be correlated satisfactorily with each other . . . we must pay the same attention to artifacts of stone, bone, shell, etc., that has yielded such valuable results in the study of pottery." Considerable difficulties are inherent in the classification of stone implements but close inspection shows that these are further increased by a terminology which occasionally serves as much to confuse the picture as to clarify it.

Such phrases as "leaf-shaped" or "triangular" blades are common in archaeological literature. Yet the descriptive accuracy of these terms rests upon a meaningful and generally accepted contrast between leaf-shaped and triangular which is not substantiated by the inquiry into their use as presented below. Detailed attention given here to reports on point forms from the Columbia-Fraser region indicates that we cannot at the moment rely absolutely upon any discussions of comparative projectile-point types which make use of these terms, since neither verbal descriptions nor the symbols of the Strong classification system widely used in the region are consistently applied to the same artifact shape.

Phrased in this way the paper sounds largely negative. Yet it is divided into two sections both of which may be considered to offer positive results to the general problem of classification and/or typology. The first section is the inquiry into point forms from the Columbia-Fraser region. Projectile-point types which were adequate for site descriptions were found to be inadequate for close comparative work. The publication of new data, however, answered several local problems; new types were discovered; and additional criteria of classification are given which may prove to have value wherever the so-called leaf-shaped blade occurs.

The second section is a comment on the nature of the types set up in the first. The whole paper is concerned with the definition and practical validity of certain attributes of classification and this section relates the inquiry to the concept of the archaeological type. Attributes are seldom given very full treatment in discussions of archaeological method. The emphasis placed on them here seems to suggest that the aspects of a type which are ordinarily linked together in one way or another might profitably be viewed as rather distinct. They may be distinguished during the procedure of analysis as the observed type, the ideal or abstract type, and the artifact type. This terminology in which three types constitute a single type is admittedly awkward and it might be preferable to speak of observed "groupings," ideal or abstract "groupings," and artifact "groupings," (or "groups"). The term "type" has been retained here in each case since it seems to conform better with previous discussions.

I

The area. The Columbia-Fraser region derives its name from the dominating Columbia and Fraser river drainages. In it are included parts of the Plateau and most of the southern Northwest Coast. An extensive bibliography of the area was given in Smith (1950). Reference to more recent work is included in this paper, and the main sites or locations mentioned are shown in Figure 1.

Pottery is generally absent from the artifact assemblages of the region; metal is rare and when it occurs is worked natural copper or trade iron. Ground stone pieces, and bone and antler work, are present at all sites but vary greatly in quantity, and the number and quality of decorated objects also vary greatly from one site to the other. Chipped artifacts belong to the same general categories: mainly knives (or choppers), scrapers and projectile points.

* The original of this paper was presented at the XXXth International Congress of Americanists held at Cambridge, England, in September 1952. I should like to express here my appreciation to D. G. Denoon for having the drawings made for me and to Anne Deakins for typing the manuscript for publication.

There are generally greater variations in chipped points than in any other class of artifact and some reliable means of comparison of chipped-point types becomes, therefore, of major concern.

Criteria for classification. Classifications of projectile-point types have attempted to objectify descriptions within a class of artifacts numerous enough and widely enough distributed to lead to expectations of success from detailed comparisons. The terms "leaf-shaped" and "triangular" are applied generally to knife blades and other artifacts, and are here examined in the context of projectile-point classification where this effort at precise description for comparative purposes is furthest advanced. The system of classification most used for Columbia-Fraser materials depends upon form or shape and is mainly two-dimensional, since thickness is not taken into account except possibly in the original sorting of the specimens by function. The system was modified by Strong (1935) and is an elaboration of his work in the region. It is based on earlier schema of Wilson (1898), and Gifford and Schenck (1926). Strong intended his system more as a guide to classification than as a final word on point types and he meant that it "should be modified at will to suit special material" (1935, p. 89, fn. 66).

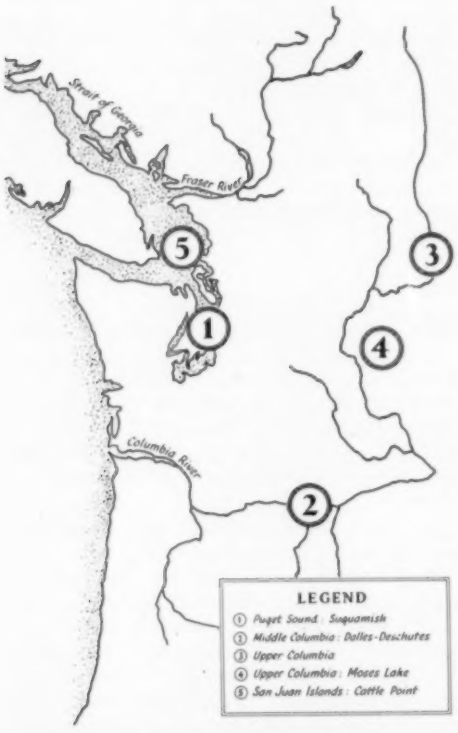

Fig. 1. The Columbia-Fraser Region.

The primary basis for classification is the presence or absence of a stem, indicated by capital S- and N- respectively. In working with stemmed points at the Dalles-Deschutes, Strong, Schenck and Steward (1930, p. 80) wrote that "There remains some question whether the shape of the stem . . . or the presence of a shoulder or barb . . . should be chosen for secondary classification. We endeavor to present data so that either may be used." N- points, or those with no stems, are classified secondarily as to whether the blade is leaf-shaped or triangular. Other details of form are subsequently added. Thus, a point from the Dalles-Deschutes material designated by Strong, Schenck and Steward as capital N-, capital -A-, small --b, number ---1, *i.e.* NAb1, is nonstemmed, leaf-shaped, pointed at one end, with the blunt end having a convex base (see Fig. 2). This is retained in Strong's later (1935) classification.

King (1950), working in the San Juan Islands, regards shape of blade as being more important than the presence or absence of a stem. His classification "is based primarily on the form of the blade . . . since it seems . . . that this is the basic portion of the tool" (1950, p. 13). He therefore lists all points first as either triangular or leaf-shaped and then as stemmed, nonstemmed or notched. It is clear from his Table 9 that he calls any point with outwardly curved sides a leaf-shaped point. King's weighting of significant features seems to be the same as used by de Laguna in referring to our region. In drawing parallels between two Yukon chipped points and points from the Columbia-Fraser, she describes them (1947, p. 173) as "leaf-shaped with tang." She makes it clear, however, that had her material warranted it she would have included further details of "the shape of the tang, proportions of the blade, and the presence or absence of notches." King also considers such features. Proportions of the blade, and of the stem, have likewise been used to elaborate upon the letter-number

system in the Columbia-Fraser region (Garth, 1952, p. 51; Smith, 1950, Table 1, etc.). Considerable agreement, therefore, seems to exist as to the various criteria available although the weighting given to some over others, or the combination used for any particular material, may vary.

Osborne, Crabtree and Bryan (1952), in recent work in the upper Columbia valley not far from the Moses Lake region, use both material of manufacture and form as primary bases of comparison. They do not employ Strong's letter-number designations but in describing points follow him by placing greatest reliance in form determination on the absence or presence of a stem. In discussing nonstemmed points, they equate leaf-shaped with oval (pp. 363, 365). This undoubtedly conforms with Strong's usage since the NAb1 point of his diagrams could easily be described as roughly oval or elliptical.

The problem. The problem concerning leaf-shaped points with which this section of this paper deals first arose in classifying materials from Suquamish (Smith, 1950, p. 17) when the oval point from the Dalles-Deschutes was found to have been classified the same (NAb1) as a point of quite different outline from the upper Columbia sites. For the contrast between these points see Figure 2. Suquamish points were classified according to Strong, Schenck and Steward, thus corresponding with the Dalles-Deschutes material. But the differences noted in classification discouraged detailed comparisons with the upper Columbia data.

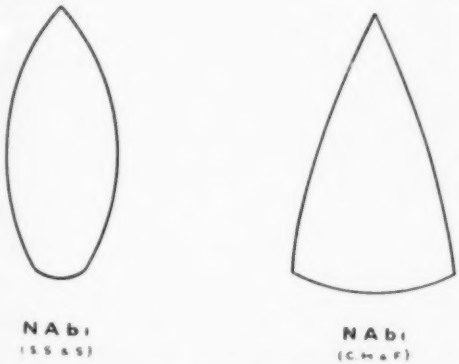

FIG. 2. Diagrams of leaf-shaped points classified as one type (NAb1). Middle Columbia (left) after Strong, et al., upper Columbia (right) after Collier, et al.

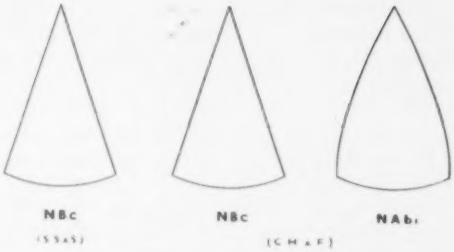

FIG. 3. Diagrams of triangular (NBc) points compared with upper Columbia "leaf-shaped" (NAb1) point.

Materials described by Strong, Schenck and Steward and by Collier, Hudson and Ford both contained nonstemmed, triangular points with convex bases and straight sides, classified NBc and agreeing both with the system and with each other. The distinction made by Collier, Hudson and Ford between their triangular points (NBc) and their leaf-shaped points (NAb1) rested solely on the presence of curved sides (see Fig. 3). Both Mills and Osborne (1952) and Osborne, Crabtree, and Bryan (1952), working on the upper Columbia, illustrate points identical with Collier, Hudson and Ford's NAb1 or leaf-shaped points. They call them triangular, however, despite their curved sides.

None of the sources quoted proffer any explanation of what they mean by leaf-shaped or triangular. Nor does Drucker (1943) in his careful examination of artifacts from just north of our region define the terms except through reference to Strong (1935). By inference, his NAb1 is oval like the NAb1 of the Dalles-Deschutes and Suquamish materials. (Strictly speaking, the northern Northwest Coast overlaps the Columbia-Fraser region only in the area of the lower Fraser. However, Drucker includes the inland-water areas of the Columbia-Fraser region in his Straits of Georgia-Puget Sound aspect. He also speaks of "a specialized or modified aspect of a Plateau, or, perhaps better, Fraser-Columbia River phase" (1943, pp. 127-8)). The importance of this point for comparative purposes may be judged by the fact that Drucker finds NAb1 the most important type in the Strait of Georgia region and at the same time the one most widely distributed throughout all of the northern Northwest Coast (1943, Table 8). But what

is an NAb1 (nonstemmed, leaf-shaped, convex base) point in the Columbia-Fraser region adjoining the Strait of Georgia? And may curved sides give either a leaf-shaped or a triangular point? Or are only oval points leaf-shaped?

Correspondence of description and form. The new work by Daugherty in the Moses Lake region (O'Sullivan Reservoir) solves one part of the local problem. Daugherty (1952) does not use letter-number designations but he uses the same criteria as Strong (1935) and similar outline diagrams. He furthermore arranges his points in the same order. His type 2 projectile point is placed between two clearly oval types (his types 1 and 3, the latter of which is seen in Fig. 4, the former is similar in proportion but double pointed). The position of his type 2 point suggests that he regards curved sides as significant in placing points in conjunction with points of more oval outline. The more important thing, however, is that he reports *both* types (see Fig. 4). His sites, which lie geographically between the Dalles-Deschutes and the upper Columbia sites reported earlier, yield points identical both to the NAb1 of Strong, Schenck and Steward and to the NAb1 of Collier, Hudson and Ford. The accuracy of the earlier reporting seems to be confirmed by the distribution — points of the types found to the south and north occurring together in the central site.

Thus points of both NAb1 types are present in our general region and the differences in the diagrams of the authors represent real differences in point types. It should also be noted that the careful reporting of the original data was the only thing which makes further work possible. By keeping to the forms of the points, rather than to any classification system *per se*, accurate accounts were given and the system was used as was intended. Criteria were adequately varied to suit special materials. But they also vary so much that adequate comparison of materials is difficult. It is when the various descriptions are brought together and equated that the discrepancies in terminology appear. It should be added that most of the recent work in the Columbia-Fraser region has not been mainly comparative. Garth (1952), however, in establishing his cremation complex and the ties he sees between it and modern Sahaptin, uses comparisons both of sites and of archaeological and ethnological materials. He lists five NAb- types (Fig. 41) but makes no mention of the discrepancy in classification of leaf-shaped points, although the problem has already been indicated in the literature. Since he gives diagrams, the effect of this neglect is somewhat neutralized, yet "leaf-shaped" blades are referred to in the discussion in which cultural connections are suggested. In any total mass of data this single fact may seem insignificant. Yet the problem in connection with classification remains and verbal discussions of blade shapes may be correspondingly misleading.

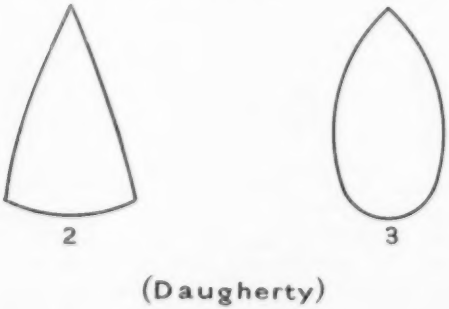

FIG. 4. Diagrams of two unclassified types from Moses Lake, upper Columbia (after Daugherty).

Confusion of terminology and stability of form. Collier, Hudson and Ford illustrate three points which they classify as NAb1 (1943, Pl. 1, a-c). Of these, two are very close in form to their diagram (see Figs. 2 and 6) with shallowly convex base and gently curved sides. The third (Pl. 1, c) corresponds less closely to their diagram, but makes it abundantly plain why they classified this group of points as leaf-shaped. It is large, has richly curved sides, well-rounded base, and no hint of corners (Fig. 5, *a*). This is, indeed, almost a perfect example of the form which many archaeologists seem to have in mind when they refer to leaf-shaped blades. Daugherty (1952, Fig. 114, *f*, 8) illustrates what seems to be an exactly similar point, only identifying it as a knife because of its size. Furthermore, although he refrains from applying "leaf-shaped" to any of the artifacts he identifies as projectile points, he does not hesitate to call this blade "leaf-shaped" (p. 381). The same form, in the same large size, appears in Dalles-Deschutes materials (Strong, et al., 1930, Pl. 12, c) and is classified unquestionably by Strong, Schenck and Steward

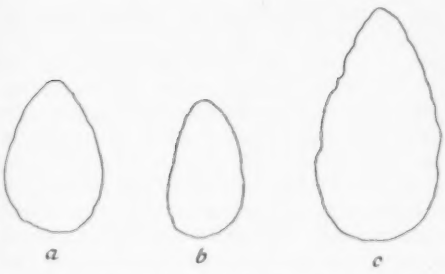

FIG. 5. Outline tracings of illustrated leaf-shaped points (or knives?), forming observed type 1: *a*, 2 5/8 in., upper Columbia (after Collier, et al., Pl. 1, *c*); *b*, 2 4/5 in., upper Columbia (after Daugherty, Pl. 114, f, 8; *c*, 3 1/5 in., middle Columbia (after Strong, et al., Pl. 12, c).

as a leaf-shaped (NAb1) blade. It is not reported for either Suquamish or Cattle Point.

Comparisons of point sizes such as are found relevant in the types just described are readily drawn for single sites. In comparing "large" points from one site to another, however, as we have just done, absolute sizes are necessary and these are not always easy to discover from reports or illustrations. Absolute figures given are often those of range: thus King gives our Figure 7, *e*, a range over five points of L 3.1-4.25, B 1.6-2.7, Th 0.35-0.75 (centimeters) and for our Figure 7, *f*, a range for seven points of L 4.85-5.7, B 2.2-3.7, Th 0.6-1.7 (p. 13). Suquamish ranges are for our Figure 6, *a*, L 41-76, B 24-40, Th 6-15 (millimeters) over fifteen points; and for our Figure 7, *c* and *d*, L 22-34, B 14-19, Th 3-4 for fifteen points (Smith, Table 1), the extremes within these being illustrated. Other measurements may be figured out on the basis of illustrations: Suquamish points are reproduced ½ natural size, as are those of Mills and Osborne; King offers a scale with his drawings of projectile points, and Daugherty photographs his against squared paper, Collier, et al., and Strong, et al., give length measurements for one point on each plate, the former in inches, the latter in millimeters. Sizes of our illustrated points (Figs. 5-7) are figured on these bases but are approximate only. Diagrams of point types, of course, are not drawn to scale.

The two points illustrated by Collier, Hudson and Ford (1943, Pl. 1, a and b) which agree with their NAb1 diagram are also large and seem to be the same form as a Suquamish point (Smith, 1950, Fig. 2, *18*) classified in a subclass of NBc identified by proportionate size as "large" (Fig. 6). The sides of the Suquamish point illustrated are slightly less curved but the degree of curvature might vary within this range from specimen to specimen. Each of the points is similarly chipped at the base line and they apparently belong to the same type. In describing Suquamish NBc points these authors said that "the corners of these points are rounded, making the class as a whole merge into NAb1" (p. 11). The diagram of NAb1 (see Fig. 4) given by Collier, Hudson and Ford shows corners as well as convex sides but from the illustrations they offer one judges that the corners are rounded rather than sharp. Daugherty's diagram of his type 2 point (Fig. 4) also shows corners. It is further illustrated, however, by a small point (Daugherty, 1952, Fig. 114, *b*, *2*) which has rounding at the corners and which is similar to a small Suquamish point (Smith, 1950, Fig. 2, *21*); to a small point from the upper Coulee which Mills and Osborne call triangular (1952, Fig. 107, S); and to one from the upper Columbia called leaf-shaped (Collier, et al., Pl. 1, *d*). It is clear that this is the same form as a somewhat larger point from Suquamish (Smith, 1950, Fig. 2, *20*). These last two Suquamish points were grouped together in one subclass of NBc (triangular). They seem to constitute a type for they reappear in identical form and size range at Cattle Point (King, 1950, Fig. 9, *7* and 9) where King calls them "leaf-convex base" (Fig. 7).

Suquamish triangular (NBc) points were classified into three subclasses, the two mentioned above and a third (Smith, 1950, Fig. 2,

FIG. 6. Outline tracings of illustrated points now variously classified, forming observed type 2: *a*, 3 in., Puget Sound (after Smith, Fig. 2, 18); *b*, 2¼ in., and *c*, 2½ in., upper Columbia (after Collier, et al., Pl. 1, b and a).

19) in which the blades were fairly small but proportionately long and slender. This is reminiscent of Daugherty's type 4 (1952, Fig. 113) but it is clear from his illustration (Fig. 114, *b*, 4) that that form has two sets of corners: one at the juncture of sides and base, and a second half way along the base; actually, the base is itself three sided and not truly convex. Collier, Hudson and Ford illustrate two similarly sized and proportioned tools which have two points and are classified by them with leaf-shaped blades (NA-): one of these (1943, Pl. 1, *l*) has definite corners and approaches a diamond form, whereas the other (Pl. 1, *m*) has convex sides and is more nearly oval. The form of the latter point is similar to that of two artifacts identified as drills (Pl. IV, *b*, *c*). A wide diamond-shaped point occurs at Suquamish (Smith, 1950, Fig. 2, *31*) and at Cattle Point (King, 1950, Fig. 9, *48*) and is classified "diamond" (SAc) for both localities. Its proportions and size clearly indicate, however, that it is a different type from the slender tool under consideration. Borden lists an "NAb1 (very slender)" point from Locarno Beach in the lower Fraser area (1950, pp. 15, 16) but without diagrams or illustrations so that the exact form is difficult to assess. (He also lists NAb1 points for two other sites in the lower Fraser (pp. 19, 20). One of these he gives as "NAb1 (?)." He makes no mention of NBc points. His work on the lower Fraser promises most interesting results but reports on it to date have been only preliminary and do not serve for detailed comparative studies.) A slender single-pointed artifact with very slightly concave base occurs at Cattle Point (King, 1950, Fig. 9, *4*, *26*): King differentiates two of these, calling one "leaf" and the other "triangular-isosceles," apparently because of a slightly convex curve on one side of the leaf form (Fig. 9, *4*). And, finally, two slender, double-pointed artifacts are illustrated for the Dalles-Deschutes materials (Strong, et al., 1930, Pl. 12, *a*, *b*); one of these is more markedly oval than the other, but neither is similar enough to any of the forms described above to be equated with them; they have no corners and are classed as leaf-shaped (NA-). Unlike the other three types already discerned, nothing in either the form or distribution of these slender points would suggest that they constitute a single type. Whether their proportionate size is important enough to serve as a separate category, thus linking them together, can only be determined by further data and investigation.

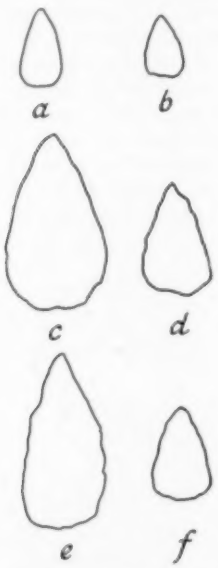

FIG. 7. Outline tracings of illustrated points now variously classified, forming observed type 3: *a*, 1 1/10 in., upper Columbia (after Daugherty, Fig. 114, b, 2); *b*, 3/4 in., upper Columbia (after Mills and Osborne, Fig. 107, s); *c*, 2 3/16 in., and *d*, 1 5/16 in., Puget Sound (after Smith, Fig. 2, 20-21); *e*, 2 3/4 in., and *f*, 1 1/2 in., San Juan Islands (after King, Fig. 9, 9 and 7).

The other convex-based points discussed above have grouped themselves more readily into types. Three such types of artifacts have been distinguished: (1) the large point (or knife?) of the Columbia River valley which is clearly "leaf-shaped" though by no means "oval" (Fig. 5); (2) a large point from the upper Columbia and Puget Sound (Suquamish) which is classified both as "leaf-shaped" and "triangular" (Fig. 6); and (3) the smaller point which occurs in identical size range on Puget Sound (Suquamish) and in the San Juan Islands (Cattle Point) and is also variously classified (Fig. 7). These are the types referred to in the second section of this paper as "observed types."

It can be seen that the large points of type 3 are similar in form and roughly in size range to the points of type 2. They are distinguished from them, however, by the nature of the

chipping at the base. In classifying *by form* this feature was naturally disregarded by the authors who described them but might have led other authors to group them with knives. Classification by supposed function offers additional problems which lie outside the content of this paper. I may add in regard to the Suquamish type 2 specimens that polished adz blades seem to be relatively recent on southern Puget Sound and these large chipped points may have been used as adz blades. This is just a surmise but their large size still serves to distinguish them from the Suquamish and Cattle Point "medium-small" points of this form falling in type 3.

These, and other types not distinguished here, may be stable but it has been shown how confused the terminology is. Are there no criteria which will lead classifiers to agree as to the forms of these points and, at the same time, distinguish between what seem to be separate types now classified together?

Criteria for more exact classification. If the same criteria are used, it does not seem important for site description how they are weighted. Whether shape of blade or presence (or absence) of stem is regarded as primary makes no difference, since either or both may be valuable for comparisons. Both the letter-number system and verbal descriptions (including those of the typological method) now fully recognize this fact. However awkward it may be to compare materials which have been described with different criteria weighted as primary, true difficulties arise only when the classifier follows inadequate criteria.

The major pitfall seems to be the curved side. This may or may not be considered sufficient basis for classification as leaf-shaped. A truly convex side would, of course, yield an oval point. But convexity is used as loosely as the leaf-shape and many sides which are merely curved outward (as opposed to straight) seem to be confused with "convex." The convex and outwardly curved side could be sharply distinguished, thus distinguishing the oval from the leaf-shaped blade. But, since this distinction is already implicit in the terminology and has, in use, proven inadequate for accurate description of point form, some additional criterion seems practically necessary to avoid confusion. If we added some other criterion, could this confusion be averted? The oval, leaf-shaped point not only has convex sides but, if it is single-pointed, also has a *base which is substantially narrower than the maximal breadth of the blade.* The same is true of the base of the rounded point (Fig. 5) consistently classified as leaf-shaped. The difference between them lies in the distance between the base and the maximal breadth of the blade.

In the *oval* point the maximal breadth occurs about equidistant from the ends; in the non-oval, *leaf-shaped* point the maximal breadth of the blade comes much nearer to the base than to the tip. When an author uses both these terms it may be assumed he has both forms in mind. But when only leaf-shaped points are mentioned confusion seems to occur and it becomes necessary to specify the position of the maximal breadth of the blade. If both curved sides and this new criterion were used, there would be less doubt as to the form being described. To be completely accurate, the exact position of the line of maximal breadth should be specified, with some arbitrary line dividing leaf-shaped from oval. But, since form is so dependent upon proportionate measurements, to do this seems overzealous unless a particular type is being described. It is doubtful whether classification in which leaf-shaped and oval were thus meticulously differentiated would be meaningful. However, in procedure following the typological method, or in careful descriptions of particular points or types, information as to the location of the maximal breadth of the blade might prove valuable.

Difficulties do not arise in connection with straight-sided blades which have sharp corners at the juncture of side and base. These are consistently classified as triangular. When the sides of such a point are curved, however, there is no agreement among the classifiers noted here as to whether it is leaf-shaped or triangular. The forms of Columbia-Fraser points suggest another criterion. If corners are plainly visible, whether the sides are curved or the corners themselves are rounded, the point may be distinguished from leaf-shaped blades. Whether it is further to be identified with triangular blades, using the presence of corners as one of the main criteria of that form seems more doubtful.

For the present, it seems best to keep four convex-based points distinct for Columbia-Fraser materials: oval points (with convex sides, maximal breadth of blade greater than base and occurring about equidistant between

tip and base); leaf-shaped points (with outwardly curved sides, base narrower than maximal breadth of blade, maximal breadth of blade occurring nearer base than mid-point of blade); triangular points (with straight sides and sharp corners at juncture of side and base); and curved-triangular points (similar to triangular points, i.e., with identifiable corners, but with either outwardly curved sides or rounded corners, or both).

The material for this area would certainly be more accurately described were the presence or absence of curved sides and of corners indicated, and made use of in classification. Whether this is done by use of a letter-number system or by verbal statements is largely a matter of individual preference. When used in conjunction with diagrams and/or illustrations, either may furnish accurate site descriptions. But until the so-called leaf-shaped points and the triangular, convex-based points of the Columbia-Fraser region have been reclassified keeping these criteria in mind, comparative studies or cultural connections dependent in any way on a contrast between the two terms must be viewed with suspicion. Such suggestions made in the past must all be re-examined before they can be restated with any assurance.

This is a conclusion I have arrived at with extreme reluctance. When King's detailed data from Cattle Point appeared, they offered the first real basis for comparison with Suquamish. The sites were relatively close, they were ecologically similar, chipped stone was equally significant for both and, what was more important, Cattle Point was a well-excavated site revealing several stratigraphic levels. Preparatory to a quantitative comparison of projectile points, I therefore drew up a table incorporating King's data (anyone familiar with the complexities of his verbal classifications will realize this was no small task), and those from other available reports for the Columbia-Fraser region, within the Strong letter-number system. It is true that this detailed work led to the present paper. But the table now seems to me quite valueless. The nonstemmed points all call for reclassification and, although this may still be possible from the published accounts, it would probably be much less time consuming, and scientifically more satisfactory, to work with the points themselves. We badly need for the southern Northwest Coast and the Plateau a study of the sort undertaken by Drucker for the northern Northwest Coast. This would be a tremendous job and in the meantime my interest in detailed comparisons must go largely unsatisfied. I am no longer optimistic about any results I might achieve from printed sources. I judge it would take someone with an interest in the classification of stone artifacts — and a previous knowledge of the area — a year of solid work to crack those problems I can even now foresee, to say nothing of those which would inevitably arise as the material was reviewed.

For this region, where leaf-shaped and triangular points are numerous and distributed in quite different concentrations, the problem of inexact terminology is very real. Others must decide whether it is equally significant in their areas of specialization and whether the additional criterion mentioned above for leaf-shaped projectile points from the Columbia-Fraser region will prove valuable for other classes of stone blades.

II

In his recent article on artifact types, Spaulding (1953) has suggested a method for assembling various attributes into a type. It should be pointed out here that the type referred to in the preceding section is not the same as Spaulding's artifact type. He defines his type as "a group of artifacts exhibiting a consistent assemblage of attributes whose combined properties give a characteristic pattern . . . the combinations of attributes [being those] favored by the makers of the artifacts, not an arbitrary procedure of the classifier." His suggestions have important theoretical implications and his comment on attributes is extremely significant. The identification of traits, and the effort to keep them free of the interpretations and cultural biases of the investigator, are among the prime concerns of the anthropologist.

Spaulding has employed pottery to illustrate his suggested technique for the discovery of artifact types. But presumably artifact types could be discovered for chipped projectile points as well. If this were to be attempted at the present time, I suspect very strongly that leaf-shaped and triangular would be among the attributes used. The present paper has been concerned with the validity of these terms as now em-

ployed in a region where they are of extreme importance. Three "types" were discerned. Actually, these were more or less identical forms which were discovered to have meaningful and, to judge from the data available, consistent distributions. Each type consisted of specimens which were to all intents and purposes identical but which occurred at different locations. It was thus strictly analogous to the types established with the most obvious success in descriptions of single sites where one author was working with one set of materials. It can conveniently be labeled an "observed" type since it depends upon the exact correspondence between observed characteristics and described characteristics, and specimens are grouped within it when they hold such characteristics in common. It is akin to Rouse's "first step" in classification (1939, p. 25); Heizer's "homogeneous group of artifacts" (1950, p. 56); Krieger's "working group" (1944, pp. 279-280); and Wheat's "provisional type" (1953, p. 197). There seems to be agreement on the fact that provenience and/or distribution are as much a part of the description as the form of the point or any other of its material aspects, and that the establishment of such groups is a necessary step in classification. Few theorists, however, have much to say about criteria at this level.

Spaulding has referred to classification in the following: "The customary technique of classification consists of inspection and segregation of obtrusive combinations, or occasionally of attempting to describe all of the observed attribute combinations on an equal basis. Categories resulting from both of these methods are called 'types' " (1953, p. 306). To describe *all* of the attributes of an artifact is a formidable task, yet the most careful work attempts to do just that. In verbal discussions, however, a selection of attributes is almost inevitable. Thus the combined attributes which constitute the category leaf-shaped in stone implements have become so accepted that the type as an abstraction is often employed uncritically and may in turn become an attribute. In describing NAb1 points as "nonstemmed, leaf-shaped, pointed at one end, with the blunt end having a convex base," leaf-shaped is used as though it were a descriptive isolate precisely tied with an attribute of blade form. If comparisons are confined to observed types, i.e., groups of specimens which are to all intents and purposes identical, this causes no confusion. But as Spaulding has said: "within a group of *similar* artifacts the division into one type may be anything but obvious" (italics added). The problem of the precise definition of attributes — with which this paper has been concerned — then arises. If it is further intended to establish artifact types, or assemblages of attributes which give characteristic patterns, even if it is intended to move at all beyond the observed type for purposes of comparison, attention to the precise nature of attributes becomes mandatory.

In working over these data I have been struck by the fact that classification which is adequate for description may not be adequate for comparison. Criteria of classification which may be quite sufficient for other areas or materials were found to be too generalized to be of value on these materials. There must be a constant, and largely unconscious, process going on (to use Spaulding's terminology) of observing and segregating characteristics for one set of materials, observing and segregating them for another set, and discarding observations which are not "meaningful." In comparative work, meaningful characteristics become almost certainly those which serve to distinguish or relate the sets of materials. This is why the skill and experience of the investigator are such important factors. In this process, certain attributes may be dropped out which, upon coming to quite different materials, suddenly loom large again. Then all the materials must be re-examined from a new slant and with a fresh eye. Various objective techniques, statistical ones among them, are being suggested to overcome or, at least, to minimize the personal element in this process, and to yield results which will be inclusive enough so that they will require a minimum of revision. The letter-number or Strong system of point classification is one such device. However, since generalizations must be made, the process itself goes on.

Under these circumstances, perhaps two steps should be distinguished. The first depends upon the inspection and segregation of attributes which result in categories. Artifacts grouped in this process form an observed type. The second uses categories thus established in segregating attributes. To the extent that the second depends upon categories already set up, it departs from true observation. The correspondence between description and artifact

may consequently suffer. It is, nevertheless, a necessary step in comparative work and artifacts grouped in this process form an ideal or abstract type. This type, as Rouse (1939, p. 11) has phrased it, "refers to the attributes which artifacts of a given kind have in common, not to the artifacts themselves." It is, therefore, strange that in the definitions of his particular types, Rouse (fn. 3, p. 42) uses attributes which "emphasize the important differences between the artifacts, and ignore most similarities." However, this stresses, as others have also stressed, that it is necessary to describe the range of characteristics within the type and not merely set up an ideal or abstract in positive terms with no clue as to the possible variations within it. If both steps in classification mentioned above are kept in mind, and it is fully realized that the attributes segregated at any one time depend upon previous categories, then the corrective of reinspection can be applied, and the observed and ideal types tend to merge.

Two aspects of type have already been distinguished by Rouse (1939) in his classic paper on archaeological method. He mentions two types: "a group of artifacts" and "an abstract kind of artifact which symbolizes the group" (p. 11). He further adds that "The procedure used to form the types was classificatory. It consisted of the following steps: 1. The artifacts were classified into groups, each of which consisted of a single kind of artifact" (p. 25). The second and third steps consisted of listing the attributes, which "included things like surface finish, shapes, and designs," and naming the lists which were then defined as types in the second or abstract sense. The attributes are "presented as the descriptions of the artifacts" (p. 25) and include both leaf-shaped and oval (p. 44, etc.) which are apparently kept accurately distinct. Heizer has pointed out (1950, pp. 56-58) that Rouse's usage corresponds to the common meaning of type and is in essential accord with that of many archaeologists. As Heizer phrases it, a type is "not only a homogeneous group of artifacts but also an ideal artifact." This word has also been used by Krieger (1944) in connection with his discussion of classification and typology. He speaks (p. 272) of "the traditional or ideal pattern." The archaeologist, he feels, "working with the variable products of primitive manufacturing techniques" must "recover, if possible, the mental patterns which lay behind these manifold works." These, in turn, constitute the types with which he is concerned: groups of specimens "which have demonstrable historical meaning in terms of behavior patterns." This concept of the ideal type as existent in the mind of the manufacturers of the artifacts differs rather markedly from Heizer's use of the term. Heizer and Rouse seem rather to refer to an ideal or abstract form which exists in the mind of the classifier. Rouse has attempted to make this form as explicit as possible, but he is quite clear that his modes (or single attributes as analyzed from the artifacts) and his types (or patterns of attributes) are conceptual in character.

Each of these studies accepts the descriptive attributes, and the whole process of classification, with little or no comment. Krieger (1944), it is true, has gone to some lengths to discredit classification systems in favor of the typological method, and there is no doubt that the descriptive device suggested by him for projectile points (1944, p. 281) avoids many of the pitfalls of classification systems. Wheat, however, who has recently applied the typological method as defined by Krieger to artifacts from the Addicks Dam Basin in Texas, describes the blade of his Provisional Type 16 projectile point as "basically leaf-shaped, edges convex from tip to intersection with stem" (1953, p. 209). Convex sides are mentioned but we are still left with our original question of whether leaf-shaped means only oval or also all points with convex sides. Not only do classification systems continue in use, as our data from the Columbia-Fraser region demonstrate, but the typological method may also be ambiguous on the meaning of this tricky attribute, the leaf-shaped blade.

Without sampling the literature further, I may add that Rouse goes on to deal with his type as a "pattern of artifact characteristics." This, like Spaulding's artifact type, emphasizes the configuration of attributes. But in both cases the pattern emerges from the procedure of analysis and is in the mind of the classifier. To insist as does Krieger (and Taylor, 1948), that this step is the recovery of a mental pattern once existent in the mind of the manufacturers of the artifacts seems to open up unnecessary theoretical and psychological difficulties. Yet it is quite true that pattern is more than a figment of the analyst's imagina-

tion. Just as the ideal type is not set up by the archaeologist as an optimum or desirable type, so the pattern is discerned, not invented. It is composed of the clustering of categories. When one moves from single artifacts to groups of artifacts, observation of pattern is almost inevitable. Pattern *is there*. The problem for the analyst becomes that of devising methods for its precise observation and description, and it is in this connection that Spaulding's statistical procedure gains theoretical significance. It is not as though on one level there were simple observation of an artifact, and on another level conceptualization by the analyst. There is no such dichotomy. The process is always one of interaction involving artifacts *as seen by* analysts. The endeavor must always be to see accurately and completely, and to describe precisely.

For this purpose, it may be profitable to distinguish three, rather than the more usual two, aspects of a type. The first would consist of the immediately observed attributes, the observed type as previously discussed; the second would be the ideal or abstract type which includes reference to categories abstracted from the attributes by the analyst; and the third, the artifact type or that which includes the pattern of artifact characteristics. All of these have previously been referred to in the literature and are here only somewhat clarified or rephrased in terms of the use of attributes. There seems agreement on the fact that they are based upon groups of artifacts, are comparative, and imply cultural connections. Theoretically at least, it should be possible eventually to merge them and, in that case, the description of the type would furnish a more complete description of a single artifact within it than could be derived from that artifact alone.

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and Political Science
October, 1953.

THE LAMELLAR FLAKE MANUFACTURING SITE ON ANANGULA ISLAND IN THE ALEUTIANS

WILLIAM S. LAUGHLIN AND GORDON H. MARSH

ANANGULA IS an island 1.6 miles long and .5 mile wide, lying on the north side of Nikolski Bay about 4.5 miles northwest of Nikolski village, Umnak Island, in the eastern Aleutians. The designation of this island on United States Coast and Geodetic Survey charts is Ananiuliak, a transliteration of the Russianized form "Ananyulyakh" of the original Aleut name "Anangulagh" (from which we have subtracted the ending -gh to give "Anangula"). In current Umnak usage this island is called in Aleut "Anagulagh," and in English "Rabbit Island" from the numerous rabbits there, descendants of two pairs of domestic Belgian hares introduced onto the island in 1936 by one of the Aleuts as food for foxes which have since been removed, when the island became a bird sanctuary. The change in the Aleut form of the name for this island from "Anangulagh" to "Anagulagh" undoubtedly accompanied the shift in the dialect spoken on Umnak subsequent to the first arrival of Russians in the Fox Islands in the early 1750's. Originally the central dialect of Aleut was spoken at Chaluka (Nikolski village), but within the past 125 years this has been supplanted by the eastern dialect. The name for Anangula Island is apparently so old that the Aleuts no longer have any cognizance of its meaning, it being now simply the designation for that island.

The long axis of Anangula Island is northeast-southwest, paralleling that of most of the larger islands in the eastern end of the Aleutian chain. The central portion of the island is a long, low, rounded hill rising 100 meters. The northeast end has another hill of about 80 meters. The southwestern third of the island forms a long plateau of an almost uniform elevation of 18 meters. Most of the island's coast drops off in cliffs right into the sea or onto rocky beach ledges. There are four small coves with boulder or pebble beaches where boats may be landed. From across the water Anangula gives the appearance of an animal swimming north through the sea with just its back, its head, and its long tapering tail protruding. The Aleuts have remarked about this shape too. Without saying so in those words, they indicated that they envisage it as a whale. Their name for the northeast end with its hill separated by a slight saddle from the body of the island means "the Bust of Anangula," using as the word for "bust" a term that designates the head and shoulders of a sea mammal. The long, low southwestern tip is termed "the Tail of Anangula," with their word for "tail" (chmagh) which can apply only to the tail of a whale or of a fish but not of any other animal.

On the Tail of Anangula some 300 meters north of the island's tip along the northwest coast, on top of a bluff 17 meters above mean sea level, lies the site of the old lamellar flake manufactory. The spot, though not the highest along that shore, commands a wide view across the Bering Sea. The ridge of the Tail protects it from prevailing southeast and south winds, and so it provides an ideal protected location from which to watch for the passage of seals,

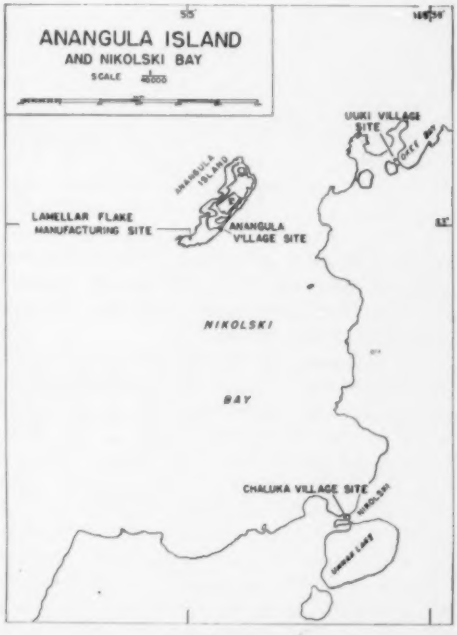

FIG. 8.

sea lions, and whales. At this particular place on the bluff is a large irregular area of blowouts covering several hundred square meters, from which the action of the wind keeps the ground denuded of vegetation (see Fig. 10). Here amidst the stones and sand on the surface of the ground lay the lamellar flakes, cores, and other material that constitute the present collection. One of the oldest of the Aleut men from nearby Nikolski village, now in his early sixties, informed us that he learned from his father that they call this place Igaghsiilugh, "the place for making stone-blades (igan)," which indicates that for at least two generations these blowouts have lain bare and that the Aleuts recognized this as a site where people had manufactured stone blades for tools. However, the modern people know nothing of the lamellar flaking technique, though the old folks have seen other kinds of pressure and concussion flaking done. How many generations this area has lain denuded, or how old the Aleut name is, can no longer be determined.

The presence of lamellar flakes and polyhedral cores at this site was discovered in July, 1938, by W. S. Laughlin when the U.S. Coast Guard ship, *Ariadne*, transporting one of the late A. Hrdlicka's expeditions to the Aleutians had to anchor in the lee of Anangula Island awaiting abatement of wind to be able to land at Nikolski village. While ashore on the island Laughlin and Alan G. May of Wenatchee, Washington, each made a small surface collection of lamellar flakes, polyhedral cores, and chipped tools from the blowouts (Laughlin 1951). Although Hrdlicka had no interest in these finds, they gave him a selection of artifacts gathered, which presumably went to the U.S. National Museum with the Aleutian collection of that season.

On the southeast side of Anangula Island, situated on top of a cliff 30 meters above the sea at a point where the Tail of Anangula starts to rise up into the body of the land, lies the old site of Anangula village. Twenty-four house pits ranged in three irregular rows stretch out along 125 meters of the crest of the bluff. Dense vegetation, largely of monkshood (*Aconitum maximum*) and ryegrass (*Elymus mollis*), blankets the entire village area, demarking it sharply to the eye from the smaller and sparser grassy vegetation of the surrounding flat. Back of the village to the northwest the ascending ridge of the island protects the site from northwest, west and northeast winds. The location of the village affords a view of the whole of Nikolski Bay and the southwestern end of Umnak Island. A small rivulet springs from the edge of the cliff and descends in a steep draw to the shore. This provided a water supply and an access to the beach-bench at the foot of the cliff, where there is a cobbly strand and a gravelly flat behind a pinnacle rock. The midden material extends to the edge of the bluff and is, in fact, in process of sloughing down over. The well-defined house pits average 1 meter in depth and vary in width from 4 to 6 meters and in length from 6 to 9 meters, with a scattering of smaller round pits. Looking down from the ridge behind the village we discerned on the flat northwest or west of the site a half dozen structures each outlined by two trenches in the form of a V, with the apex of the V in every case on the uphill end. Our old Aleut informant, upon being questioned, described these as storage pits for roots (Aleut "umqan"). The purpose of the V-shaped trenches was to drain the floors of the root cellars that lay

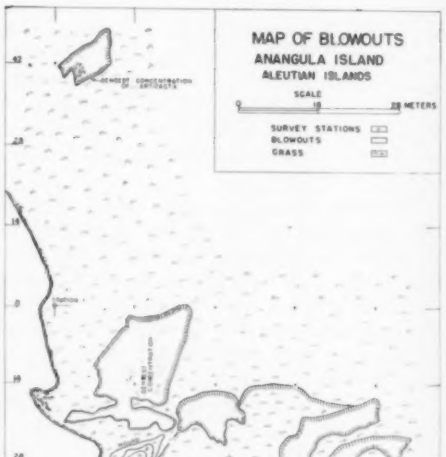

FIG. 9.

inside each V. There was actually a small pit in the middle of each V, and one large V near the edge of the midden enclosed three such pits. Test excavation of a number of these "umqan" revealed that they contained only floors constructed of whole and fractured stones.

Almost due west of Anangula village on the opposite shore of the island, located on a slope some distance away from and above the sea, is another small village site in which some 6 house pits could be discerned. Since this site was much smaller and all indications pointed to its having been contemporary with Anangula village, possibly a summer settlement, we did not investigate it further.

In the summer of 1952, working under a grant from the Arctic Institute of North America, with funds provided by the Office of Naval Research, part of our work was the complete examination of this lamellar flake factory site on Anangula Island. Three members of the expedition — W. S. Laughlin, G. H. Marsh, Philip Spaulding — and the Aleut Afenogin K. Ermeloff, spent six and one-half days from July 26 to August 1 on this island. Several of the Aleuts lent their aid and two power dorries to move the party from Nikolski to Anangula and back. The party camped in two tents at the foot of the cliff below the Anangula village site. From there it involved only the ascent of the bluff to reach the excavation in the village site and another 20 minutes walk to the lamellar flake factory site. At a later date two other members of the expedition, James Leach and Philip Newman, visited the island and made a complete map of the village site and excavation.

The factory site was investigated first. Then we made an excavation in the Anangula village site for the purpose of determining whether there might be a relation between the habitation of the village and the operation of the lamellar flake manufactory, and if so, what the connection might be in a time sequence.

Surface examination of the factory site led us strongly to suspect that the site had no depth. After photographing and mapping the blowout areas, all artifactual material was systematically picked up from the surface of the ground (Figs. 9, 10). Following the assembling of all the surface material a trench was dug 1 meter wide and 10 meters long, extending from the edge of the bluff inland

FIG. 10. Photograph showing nature of the surface and part of the extent of the blowouts, Anangula Island.

more or less longitudinally of the largest blowout. In addition to this trench, test pits were sunk in several places in the other blowouts as well as in some of the sod-covered areas surrounding the blowouts. The trench and the test pits all revealed the same story. No artifacts occurred below the surface of the blowouts nor under the vegetated surfaces. The digging in the blowout sectors was all through practically sterile soil. Furthermore, the whole region was underlain, at an average depth of about 50 cm. below the surface of the blowouts, by a layer of brown volcanic ash. Howard A. Powers, Geologist-in-Charge of Volcano Investigations at the Denver office of the U.S. Geological Survey, has most kindly provided us with an analysis of samples of this volcanic ash substratum (personal communication, 1953). The pellets of pumice were rounded, either by water action for a short period on the beach or through having been moved along the ground by wind action.

The collection of artifacts from the lamellar flake factory site consists of 1652 pieces in the following categories:

Unworked lamelles		Retouched lamelles	Totals
limy chert	70	4	74
cherty shale	27	34	61
chert-cherty shale	226	0	226
basalt and andesite	207	20	227
obsidian	80	45	125
Totals	610	103	713

		Totals
Cortex flakes, lamellar (does not include all possible ones)		
limy chert	4	
cherty shale	21	
chert-cherty shale	0	
basalt and andesite	15	
obsidian	4	
Totals	44	757
Spall (non-lamellar) flakes		859
Cores		
polyhedral		
limy chert	1	
cherty shale	1	
chert-cherty shale	7	
basalt and andesite	1	
obsidian	3	
Totals	13	13
polyhedral fragments		
chert-cherty shale	1	
obsidian	2	
Totals	3	16
non-polyhedral		
cherty shale	1	
chert-cherty shale	8	
obsidian	1	
Totals	10	26
Tools, non-lamellar		
chert scraper	1	
obsidian scraper	7	
obsidian knife	1	
pumice abrader	1	
Totals	10	10
		1652

This count represents the total number of artifacts recovered from the Anangula Island lamellar flake factory site with the exception of the small collection taken back to the U.S. National Museum by Hrdlicka in 1938, which can hardly number more than a dozen flakes and possibly one core, and the small collection, described below, now in the hands of Alan G. May. The present study includes all the pieces discussed by Laughlin (1951). In all possibility, therefore, this collection here comprises at least 98 per cent of the total material available at this site.

A. G. May has kindly lent us his collection for comparative study. It comprises 20 pieces. Of these 3 are unworked complete lamelles (1 chert .65 cm. thick, 1 andesite .78, 1 andesite .58); 5 are lamelle scrapers (1 chert 1.35, 1 chert .57, 1 andesite .70, 1 obsidian .76, 1 obsidian .73); 4 are gravers (1 chert 1.17, 1 chert .40, 1 andesite .93, 1 obsidian .76); 3 are polyhedral cores (2 chert, 1 obsidian); and 5 are non-lamelle scrapers.

Classification of Lamellar Flakes and Polyhedral Cores

Our analysis of the core and flake artifacts led us to the selection of six sorting characteristics by means of which we distinguished lamellar flakes from ordinary spall flakes: 1) bulb of percussion, 2) bulb on the concave (core) surface of the flake, 3) the noncore surface is prismatic, 4) the axes of the two edges of the flake are approximately parallel or converge slightly toward one end, 5) the core surface is concave to straight, 6) the core surface is unfaceted. Of these six characteristics the first and second need not be present, that is, the end with the bulb may have been broken off. However, if a bulb is present, it must be on the concave surface, rather than on the convex surface as is characteristic of most ordinary spall flakes. In practice then, all flakes classified as lamellar have the sorting criteria 3 to 6, and in addition many also have a bulb which is invariably on the concave surface. This classification was found to be applicable regardless of the size of the flake. Also, all these features result from manufacture.

The cortical lamellar flakes differ from the true lamelles in the noncore surface, which is either the original unworked surface of the rock or a roughly spalled surface, and is only crudely prismatic. They share the rest of the features with true lamelles.

A few observations may be made concerning the polyhedral cores. Including those of May's we have a total of 29 cores to study. Of these, 10 are non-polyhedral and 3 are only fragments of polyhedral cores. This thus leaves 16 complete polyhedral cores which we examined. The polyhedral cores are on the average much

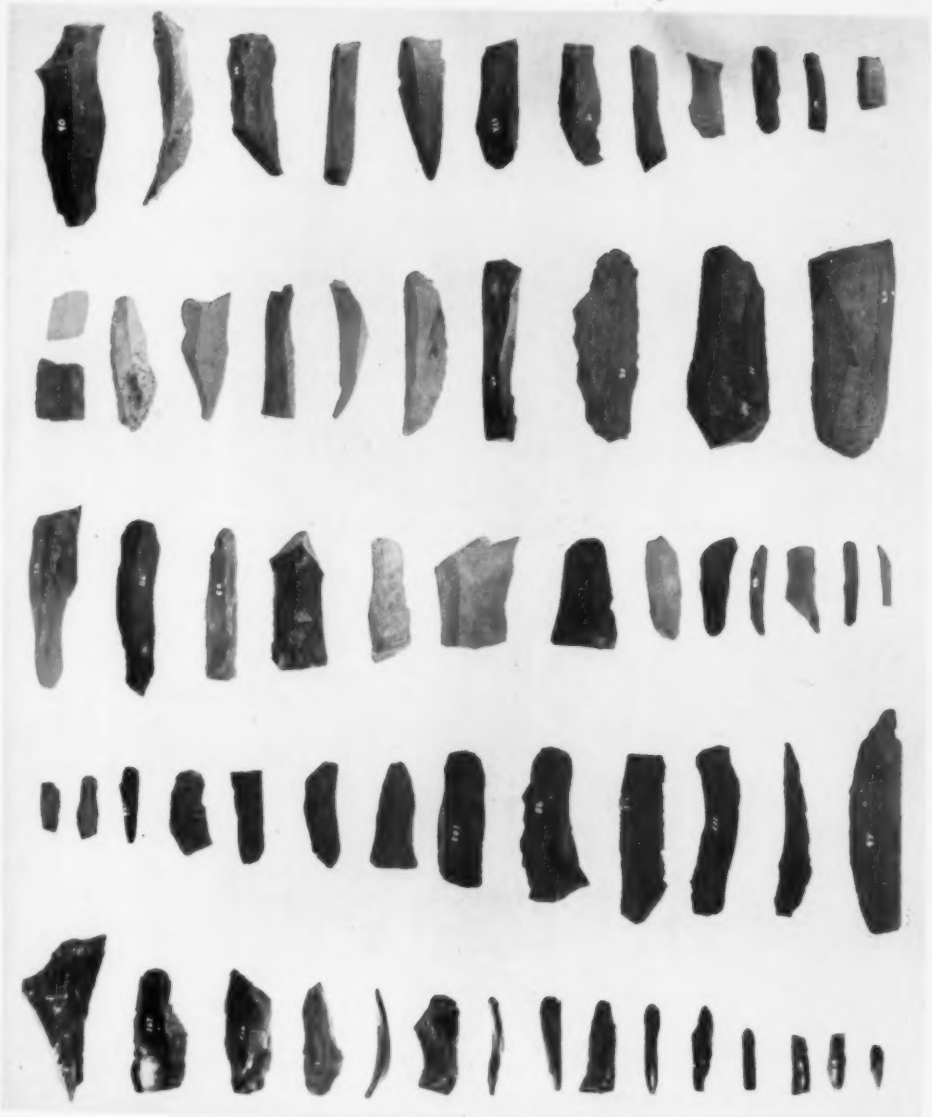

FIG. 11. Unworked lamelles. Top row: limy chert; second row: cherty shale; third row: chert-cherty shale; fourth row: basalt and andesite; fifth row: obsidian. (Specimen at extreme left top row 8.4 cm. length.)

smaller than the non-polyhedral. The largest of the polyhedral cores is a crude one of limy chert. There is 1 small one of cherty shale, 9 of chert-cherty shale, 1 of basalt or andesite, and 4 of obsidian. If the maximum length measurement is taken in the axis along which the lamellar flakes were struck off, these cores are found to range from 2.75 to 5.32 cm. The characteristics of these polyhedral cores are:

1) They all possess a prepared striking platform that has been spalled off to be approximately flat.
2) The end possessing the striking platform is largest, and all the sides tend to converge in a roughly parabolic curve toward the end opposite the platform. Some of the cores even come down to a pointed edge on the distal end.
3) The lamellar flake facets all drop away from the edges of the platform at an angle of 90 degrees or slightly less.
4) On each core there is one facet from which lamellar flakes have not been struck (Cp. Fig. 13, *10*, where the left-hand facet shows the original surface). In several of the cores this is clearly the original surface of the rock, in the rest of the cores it is a coarsely spalled face tending to be roughly flat. We may only surmise that this feature has some relation to the method of holding the cores during the flaking.
5) The end of the core having the striking platform is either roughly circular or oval.

The mineral groups into which the artifacts have been separated were kindly determined by P. W. Porter of the Department of Geography and Geology of the University of Oregon. On the basis of megascopic examination Porter sorted the artifacts into the five groups used: limy chert, cherty shale, chert to cherty shale, basalt and andesite, and obsidian. Previously he had made thin sections and a microscopic examination of actual samples from the site of limy chert (calcareous limy chert), cherty shale, and andesite. The group "cherty shale" (as opposed to "chert-cherty shale") comprises simply those pieces selected out for lesser silicious content, and merely represents one end of the whole series of cherts and cherty shales contained in the collection. This group "cherty shale" is intended to constitute a selection of the "softer" cherty shales of a hardness relatively comparable to that of the "limy cherts," while the group "chert-cherty shale" represents the harder cherts. The selection was made by ocular examination, and later we used scratch tests to ascertain the hardnesses. Porter also observed that all of the chert pieces in the collection looked sufficiently similar so that they might all have come from the same general source.

The locations from which the ancient Aleuts had gathered the materials for these lamellar flakes could not be determined. But it was not apparently right at the place of the manufacturing site since the native rock that outcrops at that point was determined by thin section analysis to be diorite (augite). The cherts were probably not brought from any great distance, and basalt and andesite are plentiful throughout the region. However, we know from the modern Aleuts that the source of obsidian was Cape Chagak (named after the Aleut word for obsidian) on the northwest end of Umnak Island. In fact, the geologists of the U.S. Geological Survey have not yet discovered any other outcrop of obsidian in the whole Aleutians outside of Cape Chagak, though artifacts of this mineral are distributed clear to the western end of the Chain.

Philip S. Newman of the Anthropology Department of the University of Oregon, a member of the expedition, measured and seriated all the Anangula Island artifacts, on funds provided by the Graduate School of the University of Oregon. It was decided that the handiest single measurement for seriating the lamelles by size would be that of maximum thickness, since this is the measurement least likely to be altered by breaking, battering, or retouching of the flakes. Maximum length could not be used since many of the flakes have one or both ends snapped off as indicated by absence of the bulb of percussion. Since width seems to have a more or less fixed ratio to thickness (Okada 1950), grouping by thickness will give the same result as by width. Likewise width measurement was decided against as being susceptible to alteration by battering or retouching of the edges. This leaves thickness as the only one of the original features of each flake not altered by subsequent treatment. Retouching has not affected the thickness since it is confined to the edges. For practical reasons, maximum and not mean thickness was measured. However, seriation by this measurement has provided an adequate basis for pointing up what we wish to show on the relative distribution in size of the lamellar flakes, both as a whole group and as

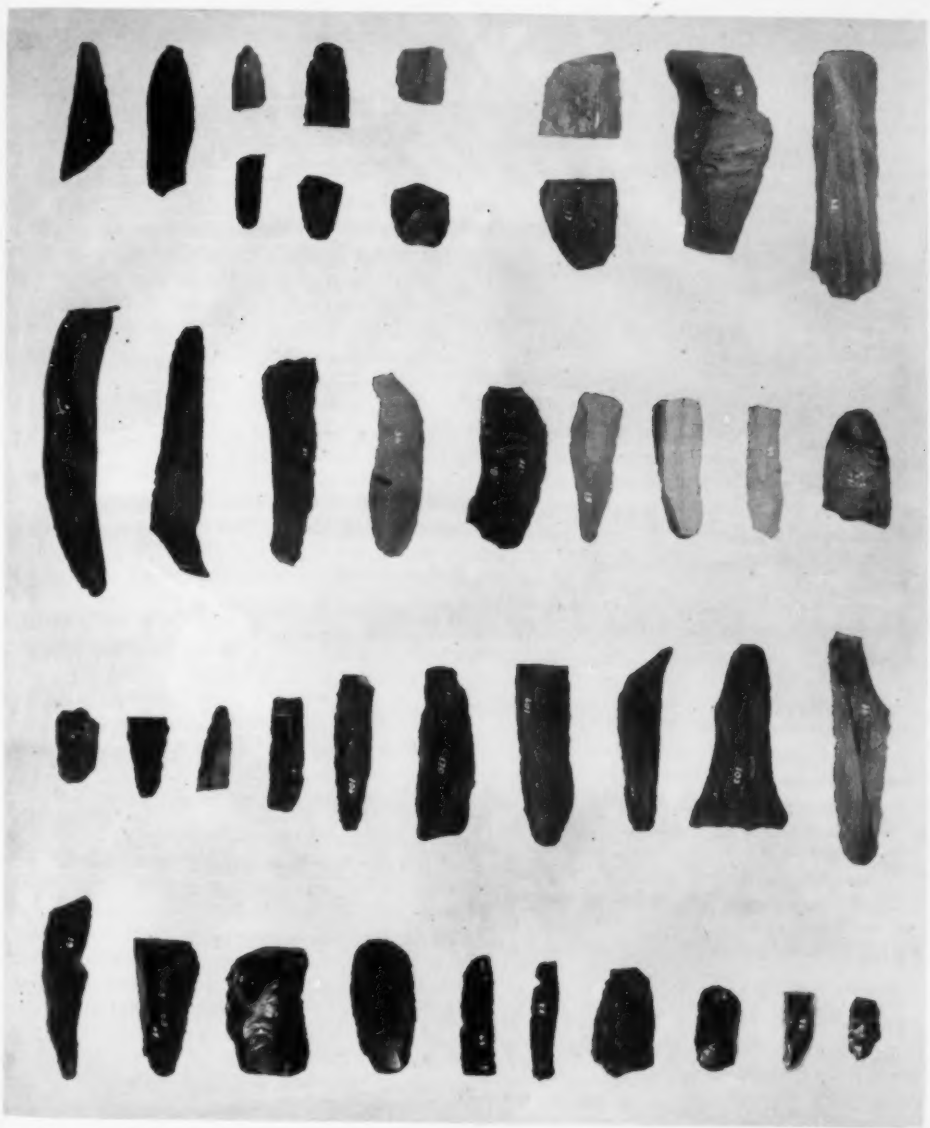

FIG. 12. Retouched lamelles. Top row right: limy chert; top row left: cherty shale; second row: cherty shale; third row: basalt and andesite; fourth row: obsidian. (Specimen extreme right top row 10.1 cm. length.)

sorted by mineral classes, and the relation of the size of the flakes to the material from which they are made.

THICKNESS OF LAMELLAR FLAKES (in centimeters)

	1 *limy chert*	2 *cherty shale*	3 *chert-cherty shale*	4 *basalt and andesite*	5 *obsidian*	*total*
Number	74	61	226	227	125	713
Range	.23-1.76	.34-1.54	.12-2.98	.20-1.90	.09-1.63	
Mean	.73	.78	.59	.62	.63	

ANALYSIS OF VARIANCE TABLE

	sum of squares	*d.f.*	*variance*	*F ratio*
Means	2.477	4	.613	$F = \frac{.613}{.0837} = 7.32$
Within	59.339	708	.0837	($F_{.05} = 2.37$)
Totals	61.816	712		

A glance at the F ratio in the Analysis of Variance Table above shows that there is a significant difference among these five populations. However, when the Means of the five populations are placed in ascending order of magnitude (.59, .62, .63, .73, .78), there is not a significant difference between any two adjacent figures. Therefore, to find where the basis lies for the significant difference within the collection of all five populations, groups 3, 4, 5 were combined and groups 1, 2 were combined. When the means for these two combined groups of populations are compared, a significant difference emerges, a difference that would be expected in less than .1 per cent of the cases on the basis of chance.

It will further be noticed in the above table of the lamellar flake thicknesses that groups 1 and 2, with the largest mean thicknesses, are numerically the smallest groups. Since on the basis of a random selection we would expect one-fifth of the total number of pieces (approximately 143) to fall within each of the five groups, there has clearly been something other than a random selection for certain of the minerals. In addition we know that obsidian was not as readily available in that area as the other minerals, since it had to be transported from 60 miles to the north. Therefore, they must have specially sought for obsidian to bring the quantity of it up to the proportion it actually shows in the table.

When the five groups of minerals are sorted by hardness, we find 3, 4, 5 contain the relatively harder minerals (obsidian 6, basalt and andesite 7, chert-cherty shale 7-8 in the Moh scale of hardness), whereas groups 1 and 2 contain softer minerals (limy chert 4-7, cherty shale 4-7). These hardness ratings come from scratch tests on samples out of the collection. Since the harder materials, which are proportionately thinner, constitute the greater number of pieces (groups 3, 4, 5 contain 81 per cent of the total), it seems that the thinner pieces were favored by the makers of these flakes.

From the archaeological investigations of the Chaluka midden (to be discussed below) we discovered that the larger lamelles were the ones retouched for tools such as scrapers and the Aleutian graver. The smaller flakes do not occur retouched either on Anangula or at Chaluka. It thus appears that these latter were used in the form in which they were made.

It is interesting to note that in other sites in the North American arctic, such as Cape Denbigh (Giddings 1951), various sites in the Brooks Range of Alaska (Irving 1951, Solecki 1950 and 1951, Solecki and Hackman 1951), and Dorset Culture sites in Canada and Greenland (Jenness 1925, Collins 1950, 1951, 1953, Harp 1951, Knuth 1952), only the smaller sized flakes have been reported.

Although this analysis indicates that the thinner blades were favored in the Anangula collection, there is nevertheless no discontinuity in the distribution between the smaller and the larger lamelles which permits an arbitrary selecting out of so-called microblades.

ESTIMATE OF TIME DEPTH

Inasmuch as the Anangula Island lamellar flake site had no stratigraphic depth, it is impossible to estimate the time depth of this industry out of the data from that site alone. Therefore only by means of a comparative study can one determine its possible position in the prehistory of the eastern Aleutians.

We have already mentioned that the modern Aleuts in Nikolski village are not acquainted with the technique of lamellar flaking. This simply indicates that the tradition for this technique does not extend down to the present in that area. These people are acquainted with other flaking and chipping techniques that were used up until the introduction of iron tools.

For the purposes of this comparison with the lamellar flake site we made an excavation in the Anangula village site. A trench was

FIG. 13. Cores and cortex flakes. Polyhedral cores: *1*, limy chert; *2*, cherty shale; 3-8, chert-cherty shale; *9-10*, obsidian; *11*, andesite. Numbers 7 and 10 May collection.

Non-polyhedral cores: *12-15*, chert-cherty shale; *16* obsidian.

Cortex flakes: *17-18*, limy chert; *19-20*, cherty shale; *21-22*, andesite; *23* obsidian. (Specimen 6 3.8 cm. length.)

dug 1 meter wide, 12 meters long, and a little over 3.5 meters deep at the deepest point, which penetrated the midden from the surface of the ground to the sterile soil beneath the cultural deposits. It is unlikely that the deposits were much deeper at some other point in the midden. Out of the 224 artifacts recovered, 116 were of stone. Out of these 116 there were 6 lamellar flakes, 3 of which were unworked and of obsidian, 3 were retouched into scrapers (2 of basalt or andesite and 1 of dark grey chert). The extreme paucity of lamellar flakes at this village site may be taken to indicate that the inhabitants of the village were probably not the operators of the lamellar flake manufactory of the south end of the island. The comparison of the artifact types from the Anangula village site with those from the Chaluka midden at Nikolski across the bay pretty well shows that the 3.5 meters of depth at Anangula correspond to the upper 2 meters of the 5.25 meter-deep deposits at the east end of Chaluka.

In the Chaluka midden, tools made from lamellar flakes were brought to light in the archaeological digs. The types of such tools are primarily scrapers fashioned by retouching one or both edges of the flake, and gravers formed by chipping one end of the lamelle down to a point and usually also with a specially shaped tang presumably for hafting —an implement shaped somewhat like the Eskimo "whittling knife," which is also abundantly represented here too. These two types of lamellar tools from Chaluka are pictured in Laughlin, Marsh and Leach (1952, Figs. 49, 50) and those from the Anangula factory site appear here on Figure 14. In addition a projectile point, a tanged knife blade, and a chisel or adz blade of lamellar flakes also occurred at Chaluka. Out of a total of 66 lamellar-flake scrapers and gravers from interpretable stratigraphy in the first three summers' excavations at Chaluka, 54 (82 per cent) came from the lowest 3 meters of the cultural deposits, and 47 of these (71 per cent of the total) occurred in the lowest 2 meters of the midden. There is in fact a layer 1 meter thick, lying between 2 and 3 meters above the bottom, extending for 22 meters across the central portion of the mound where the strata lie perfectly horizontal, from which not a single lamellar flake or lamellar tool was unearthed. Furthermore the stratigraphic distribution of the Aleutian graver, which is the most characteristic specialized tool made from lamellar flakes, likewise provides some indication of the time depth of the lamellar flake industry. In the excavations of 1948, 1949, and 1950, a total of 30 gravers from interpretable strata are at hand. Of these, 17 (57 per cent) occur in the lowest two-fifths of the cultural deposits, while 26 (87 per cent) were found in the lowest three-fifths of the deposits. The presence of 6 of these gravers at the Anangula factory site helps tie the latter more certainly to the Chaluka finds.

From the distribution in the Chaluka mound of the lamellar flake scrapers and gravers we are led to surmise that the lamellar flaking technique belongs to the earliest three-fifths of the period of habitation at Chaluka and was thereafter abandoned. Those lamellar flake tools encountered in the more recent strata would then be explained as intrusive in the sense that they would represent lamellar flakes and tools which the later occupants found, and probably used, from earlier deposits, without having the knowledge of the technique of their manufacture.

It is also important to note that almost no unretouched lamellar flakes and no cores at all were recovered from the Chaluka excavations. It is thus clear that the manufacture of these flakes, even during the period when they were still being made, did not occur at the village site. Furthermore, Anangula was apparently not the manufacturing site for Chaluka, as the cherts that are so common at the Anangula site, are absent in the Chaluka material. Those few chert pieces occurring at Chaluka are of a very different color and seem to be of a different provenience from those on Anangula. Greenstone is the chief mineral used for the lamellar tools from Chaluka. Of the 30 gravers, for example, 14 (47 per cent) are of greenstone, 6 (20 per cent) are of obsidian, 6 (20 per cent) are of chert, and 4 (13 per cent) are of basalt or andesite. It is most likely that Anangula Island was originally more closely associated with the prehistoric Aleut village of Uuki (Okee Bay, Fig. 8), 5.2 miles north of Nikolski (Chaluka), than it was with Chaluka. Anangula Island is only a little over 2 miles from Okee Bay, but 4.5 miles from Chaluka. The modern Aleuts in Nikolski still

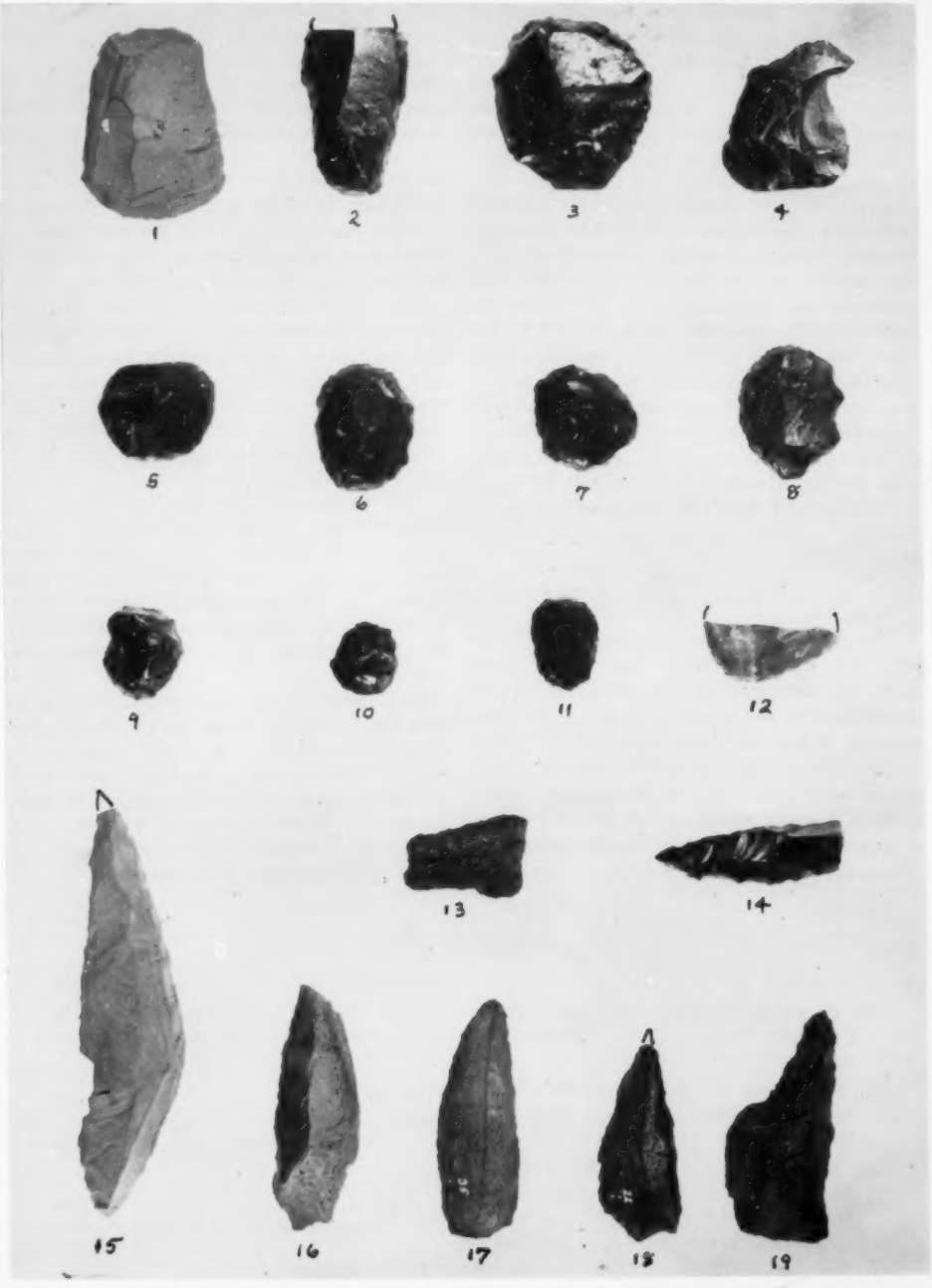

FIG. 14. Non-lamellar tools and lamellar gravers. Chert scrapers, *1, 12*; obsidian scrapers, *2-3, 5-11*; obsidian knife, *4*; pumice abrader, *13*; gravers, *14* obsidian, *15-18* chert-cherty shale, *19* andesite. *1, 2, 3, 8, 14, 15, 19* May collection. (Specimen *17* 6.3 cm. length.)

preserve the tradition that Anangula village was peopled by outcasts from Uuki village with some from Chaluka also.

In estimating the time depth of the Anangula Island lamellar flake factory site we have observed that this site was apparently not used contemporaneously with the occupation period of the Anangula village site. We have also observed that by comparison to the material from the Chaluka mound the Anangula village material corresponds to the upper two-fifths of the deposits at Chaluka. In addition we have remarked that in the Chaluka collections the lamellar flake material bulks largest in the lower three-fifths of the deposits. We have therefore assumed that the Anangula factory site belongs to the same period as the lower three-fifths at Chaluka, and that this technique of stone flaking was probably given up in this area of the Aleutians some 1500-1600 years ago (estimating from the radiocarbon date for Chaluka of 3018±230, Johnson, 1951, sample 409).

Conclusions

The Anangula Island lamellar flake site is obviously a manufactory. This is deduced from the fact that all the products of the manufacturing process are abundantly present: lamellar flakes, polyhedral and other cores, cortical flakes from polyhedral cores, and numerous spall flakes. Secondly, this was almost solely a manufacturing site for lamellar flakes as demonstrated by the rarity of tools, especially of non-lamellar tools. In this latter connection we should point out that the Chaluka finds indicate that lamellar flakes were apparently not made at the village site. A further proof that the Anangula site was used solely for manufacturing is the complete absence of the usual occupational debris — bones, shell detritus, broken tools, and the like. An additional interesting feature is the lack of special hammerstones, pointing to the likelihood that concussion was performed with the same materials that were being flaked or that punches of perishable materials were used.

The statistical analysis of the Anangula lamellar flakes by size and mineral signalizes the continuous range in sizes for each class of mineral, which does not permit the special sorting out of a separate category of "microblades." However, the analysis further indicates the distinct favoring of thinner blades made from the harder minerals.

The larger of the lamellar flakes were converted by the ancient Aleuts into certain tools, notably gravers, scrapers, with occasional projectile points, knives, and adz or chisel blades. But it is impossible to deduce from the archaeological evidence on hand the use to which the smaller and unretouched flakes were put.

By a comparison of the factory site collection with the Anangula village site and the Chaluka village site collections it seems valid to infer that the lamellar flaking technique was known and used in this area of the eastern Aleutians during the first three-fifths of the total period of human occupation and was subsequently given up about 1500-1600 years ago.

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November, 1953.

THE FRANK BAY SITE, LAKE NIPISSING, ONTARIO

FRANK RIDLEY

LAKE NIPISSING is situated 230 miles north of Lake Ontario and roughly 140 miles within the igneous rock territory. Some 30 by 8 miles in size, it is drained westerly by the French River into Lake Huron. Frank Bay, enclosing an area of one half square mile, is situated on the south shore at the entrance to the French River.

Historically the area was occupied by an Algonkian group called "Nipisinieries" or "Nipissings" by the 17th century Jesuits; Galinee's map of 1665 depicts a bay on the south shore of Lake Nipissing at the head of the French River: "In a bay at this place the Nipissings usually locate their village" (Coyne, 1903).

The site* described here, probably the one figured by Galinee, is a level tract of about one half acre constructed by wave deposition of coarse sand upon a low area at the bottom of the bay. The height of the site surface above the present summer water level is nearly 7 feet, the tract having been under construction when the lake stood at a higher level. Wave and minor wind action had continued to build up the land during aboriginal occupation; the oldest archaeological stratum was farthest from the beach; those above inclined parallel to the present surface, each deepening toward the lake.

For brief periods between 1950-1953 I excavated here, opening a single trench perpendicular to the beach that bisected the site. Although this trench involved but a fraction of the total site, and future excavations are planned, the importance of the station warrants publication at this time.

A layer of blackened sand covers the site to a depth of about 6 inches and contains articles of both native and European manufacture. Below this, in sand and ashes, lay scattered pottery-bearing strata, probably the remains of small, temporary camps which at no single period occupied more than a fraction of the full area (Fig. 15). Beneath these strata were the remains of a preceramic culture called here the "Mattawan" complex, after a nearby river and town. A total of 8 strata

* For permission to excavate and for protection of the site I am indebted to the owner Jaffray B. Smith. Others who assisted me in various ways are, F. W. McKee, T. E. Hawkins, R. Harper, S. Barley, V. B. Meen, W. A. Ritchie, Robert McKee and E. S. Carpenter.

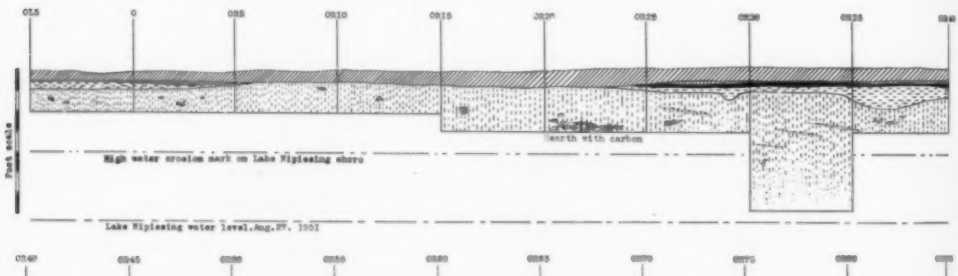
Earth with carbon
High water erosion mark on Lake Nipissing shore
Lake Nipissing water level, Aug. 29, 1951
Beach sand
60 feet to beach.
Contact Huron, Eastern Prehistoric Huron and probable Nipissing
Lalonde
Webb - Middleport
Primary and Secondary Barrie (Uren)
Transitional Woodlands
Primary Transitional Woodlands
Point Peninsula Woodlands
Golden brown sand containing cracked stones, charcoal and chipped stone tools

FIG. 15.

was divisible by a combination of physical and cultural stratigraphy; one section of the trench included them all in superimposed position.

The site was undoubtedly occupied by a series of transients; most of the artifacts lay scattered horizontally in a coarse, blackened sand; small end scrapers were relatively abundant in all strata; no heavy tools were recovered; pottery was abundant but belonged only to small and average size vessels; few intrusive disturbances broke the strata; and no burials were found, although it should be noted that bone was absent or decomposed in all levels, probably due to soil acidity.

MATTAWAN STRATUM

The basal stratum is a golden brown sand containing small, scattered pieces of charcoal, dark stained areas, fire-cracked stones, small hearths and chipped stone tools. The size of the site at the time of this occupation was indicated by two features: (1) at the inland end of the trench burnt stones were in heaps but became less numerous toward the beach and finally disappeared before the beachward termination of overlying strata; (2) certain dark stained lenses dipped beachward many yards inland from the corresponding dips of upper deposits.

The depth from the sod line to contact with the Mattawan stratum varied from 6 to 24 inches. No basal line for this horizon was observed, stained patches and firestones being encountered up to 5 feet.

There was clear evidence of seasonal or at least intermittent inundation between Mattawan occupations. Now along the rocky shores of the lake is a clearly defined water mark; a smooth nonlichen growing surface below this line contrasts greatly with the eroded green condition of the rock above. On August 27, 1951, the distance between the high water mark and the lake surface was 40 inches, while the highest surface of the site was 4 feet above the water mark. Since the highest surface of the preceramic stratum was but 3 feet above the water level marked on the rocks, northeast storms could have sent waves over it. Moreover, at Chaudier Falls or canyon, at the outlet of Lake Nipissing, this high water mark terminates; it does not appear on the shore of the channel below. The lake, once timbered at the water's edge, may have at one time or another, choked the canyon with fallen trees and thus raised the water level.

Some 140 implements are attributed to the Mattawan complex. Certain of these lay close to the overlying pottery strata, but the majority were deeply buried in the sand. No evidence of cultural or physical stratigraphy was observed in this stratum.

Trianguloid points (Fig. 16, *a, j, k*). Three complete trianguloid points and the base of a broken one were found. *a* is weathered brown chalcedony, 6 mm. thick, evenly convex on both faces, broadly flaked all over and finely retouched on the base and on one side of each edge. The basal fragment (not illustrated) is lustreless, rusty brown, heavily patinated, 6 cm. across the straight base, 12 mm. thick, symmetrical in section, with convex edges and heavy primary flaking followed by fine chipping on the edges and base. *j* is lustrous, patinated chalcedony, 6 mm. thick, with core-derived fluting on one face and a smooth plane on the other, marked serrated flaking was applied to the edges. *k* is gray chalcedony, 5 mm. thick, and derived from a flake; the flat side is finely retouched, while the base is retouched to a sharp edge.

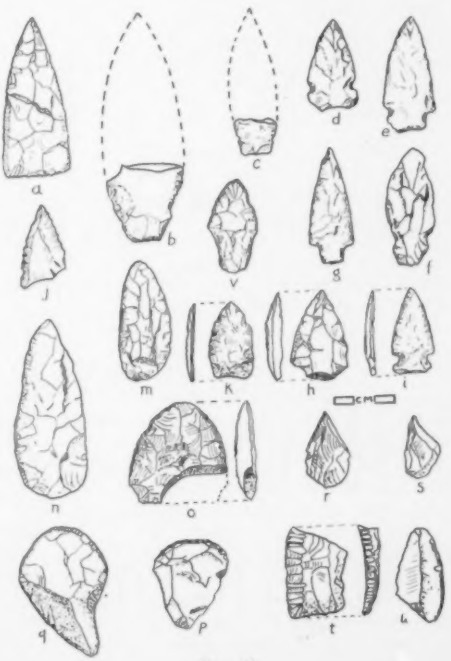

FIG. 16.

Lanceolate points (Fig. 16, *b, c*). Basal parts of 2 points, both probably of lanceolate shape, were recovered. *b* is lustrous gray quartzite, 12 mm. thick, at the fracture, with face flat or low convex and all edges, including the base, steeply chipped and finely retouched. *c* is gray chalcedony and in shape a small duplicate of *b*, both of which have small notches for binding.

Notched triangular point (Fig. 16, *d*). Heavily coated brown chalcedony, very thin, with both faces evenly convex, and sharp sinuous edges. Primary flaking was applied in a diagonal pattern followed by fine retouching on the edges. A flake was removed from each face at the base, leaving a sharp basal cavity.

Tapered stem point (Fig. 16, *v*). Gray chalcedony, 7 mm. thick, both faces evenly convex. Some fine retouching was applied to the edges.

Stemmed points, slightly notched (Fig. 16, *e, f*). *e* is milky quartz, 6 mm. thick, with sinuous, finely retouched edges and base. *f* is opaque quartzite, finely retouched, and completed on the base and one edge, though the condition of the remaining edge indicates its rejection.

Corner removed points (Fig. 16, *g, h*). *g* is heavily patinated, impure quartzite, 7 mm. thick, with the remains of the core platform on the stem base. *h* is lustrous brown and black banded chalcedony, 8 mm. thick, with a flake removed from the flat face and a core-derived flute on the opposite face. The base of the stem is a hinge fracture.

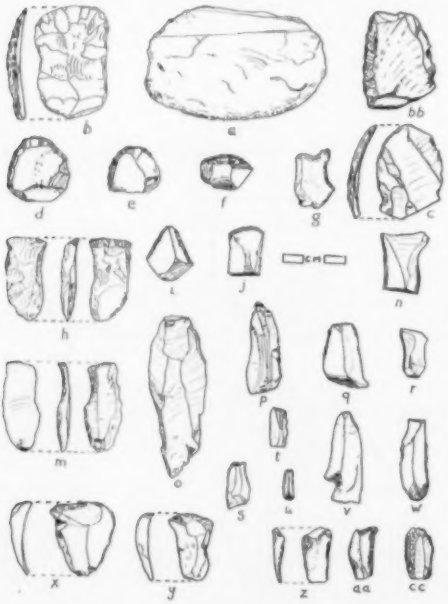

FIG. 17.

Side-notched point (Fig. 16, *l*). This point is heavily oxidized, impure quartzite, 6 mm. thick, lacking a basal edge, and finely flaked only on the flat or concave face.

Knives of narrow leaf shape and round end (Fig. 16, *m, n*). *m* is white-coated chalcedony, 10 mm. thick, with one face high convex, the other low, and with finely retouched edges on the low convex side. *n* is coated chalcedony, 13 mm. thick, lenticular in section, boldly flaked, with very fine retouching applied intermittently to a sinuous edge. A rejected, unfinished knife of the same type, made of a brown stained granitic material, is not illustrated.

Ovate knives (Fig. 17, *a*). *a* is brecciated chert, 55 mm. thick, with shallow, overall flaking followed by fine retouching on a sinuous working edge. A small fragment of gray chert, not illustrated, is 45 mm. long, 30 mm. wide, crudely fashioned, with roughly pointed ends and a small length of one edge finely retouched.

Thin, curved knives (Fig. 17, *b, c*). *b* is brown-coated, banded chalcedony, with wide, shallow flake scars over all the convex face and microscopic to fine chipped areas on the edges. The deeply concave face has only a bulb scar upon it with the remains of a striking platform at the bulb end. *c* is impure quartzite, was probably removed from a faceted core, and has small hafting notches, otherwise it is similar to *b*.

Knife with corner removed base (Fig. 16, *o*). Lustrous purple to brown chalcedony of petrified wood, 1 cm. thick, with long, low flake scars across the plano face, the convex face steeply and boldly flaked, and areas on the edges finely retouched.

Stemmed end scrapers (Fig. 16, *p*; Fig. 17, *x, y*). Twelve of these scrapers were recovered, 2 of which were unfinished rejects. Six are opaque quartzite, 2 banded chalcedony (*x, y*), 2 brown-coated chalcedony, 1 chert, and 1 quartz. Six have the remains of striking platforms on the stem ends and 5 show origin from prepared cores. They average 4 cm. in length and vary from 15 mm. to 5 mm. in thickness. Primary and secondary flaking was steeply applied at the wide end, while half have chipping on the side edges.

Small crescentic end scrapers (Fig. 17, *f*). Fourteen of these scrapers were recovered: 12 are brownish chalcedony, 2 quartzite. They average 2 cm. in diameter and are steeply chipped at the wide end. Some are chipped on the edges, giving them a triangular shape.

Semicircular side scrapers (Fig. 17, *d, e*). The 2 scrapers of this type are opaque chalcedony, identical in size and shape, with straightly fractured bases.

Side Scrapers (Fig. 16, *t, u*; Fig. 17, *bb*). *t* is milky quartz, with long narrow flaking on one edge and unmodified fractured ends. *u* is milky quartz, a keeled lamellar blade with the remains of a striking platform and corresponding bulb on the narrow end. A chalcedony example, not illustrated, is 3 cm. long with the platform and bulb at one end; it is a poor specimen with a nodule rind attached to the convex face. *bb* is

also chalcedony, 5 mm. thick, with a bulb at the narrow end and a hinge-fractured base; it is either a flat scraper or knife which originated from a large flake.

Specialized scrapers (Fig. 16, *q*; Fig. 17, *g, h, i, n, m*). *q* is a combined knife-scraper-spokeshave-graver, 20 mm. thick and greenish chalcedony. On the plano face there is a bulb scar at the rounded end, and a slight concavity extends from the point along the long edge. Rough chipping on the rounded end was followed by very fine retouching on all edges. *g* is a flat flake, steeply chipped to form a spokeshave 6 mm. thick. *h* is a combined end scraper and knife, shaped by overall flaking. The scraper end is steeply chipped and bears marks of use. A laminated flaw in the chalcedony breaks the symmetry of the knife end of the tool. *i* is a thin, trianguloid scraper, chalcedony, finely chipped at the apex end, with a striking facet and bulb at the apex of the plano face. *n* is a chalcedony, rectangular plano keeled scraper, apparently fractured across the percussion bulb and therefore incomplete. *m* is a lamellar blade, chalcedony, averaging 5 mm. in thickness, with a striking facet and bulb at the apex end. Fine chipping extends from the apex along the end and one side. Part of the edge is convex, part concave; the end is steeply chipped from an extremely concave plano surface.

Cores and Lamellar flakes (Fig. 17, *o-w, z-cc*). *o* is chalcedony and a whole, though exhausted, polyhedral core. Another core fragment is dark gray banded chalcedony. Six brownish chalcedony lamellar blades (*q-s, z-cc*) average 25 mm. in length and are finely chipped on one or both sides. *p, v* are not chipped. *w* is black chalcedony, flaked at one end only. Each has the remains of a striking platform and corresponding adjacent bulb.

Angle gravers (Fig. 16, *r, s*). *r* is finely chipped from the apex down one edge and with a polished wear facet on the point. *s* is of darker chalcedony, without chipping, but carrying the apex wear facet.

Small retouched random flakes. Fifty-one irregularly shaped flakes of brown chalcedony (reject side blades?), averaging about 25 mm. in diameter and with fine to microscopic chipping on their edges were gathered.

Partial correlation of the Frank Bay Mattawan complex is geographically widespread, but exact duplication is unknown. Archaic material similar to that from western New York is found elsewhere on the perimeter of Lake Nipissing, is reported at several stations many miles north of Lake Nipissing, and is well represented by sites and surface collections over much of southern Ontario. Nevertheless, though Mattawan and eastern Archaic share many features, differences are also great, and the two are clearly not the same. Neither does the Mattawan complex appear to be proto-Archaic, nor a regional variation of eastern Archaic, but seems to be considerably older than this general phase. Similarly, there are suggestive parallels with paleo-Indian sites; for example, Reagan (Ritchie, 1953), Shoop (Witthoft, 1952) and Brohm (MacNeish, 1952a), with material from Quebec (Rogers and Rogers, 1950), and with arctic stations, for example, Dorset (de Laguna, 1946; Wintemberg, 1939). Once again differences are obvious, and in any event too little is known of the Mattawan complex to justify interpretation at this time. Recently Paul Sweetman and I discovered a site 20 feet above the shore of Lake Temiskaming, well to the north of Lake Nipissing. In a dark top stratum, artifacts tentatively identified as Archaic, resembling Atlantic states Archaic, and Indian Knoll, overlay a deep deposit of yellow sand and alluvial gravel. In the sand, and well below the gravel, were small hearths and 8 Mattawan type artifacts.

POINT PENINSULA STRATUM

Two areas of loose gray sand containing Point Peninsula material were exposed by the trench. The deeper, which lay nearer the shore, averaged about 12 inches in depth; the second, about 6 inches. The basal line of the former was undulating with two shallow depressions or pits, while the top of the stratum was clearly defined by an overlying layer of black ash (Fig. 15).

Several large rim sections of Vinette I pottery were found, and in one of the dips that intruded into the Mattawan stratum there were many fragments of finely marked Vinette I body sherds. Other identified fictile types were Vinette Complex Dentate (Fig. 18, *p*), Vinette Dentate (Fig. 18, *g*), Point Peninsula Corded (Fig. 18, *h, j, o*), Point Peninsula Rocker Stamped (Fig. 18, *i*). Point Peninsula Plain (Fig. 17, *u*) and St. Lawrence Pseudo Scallop Shell (Fig. 18, *b, d, e, q, t*). In addition there were two rimsherds of a light colored, laminated, coarse grit-tempered, ware with a vertical rim smoothed inside and out (Fig. 18, *r*). The maker had pinched the sides of the lip, thereby drawing a small amount of paste upwards and creating a smooth, wavering lip line. Figure 18, *c* is a rimsherd, presumably from a bowl, smooth and undecorated inside and out. Figure 18, *v* is a rimsherd with the interior marked with rockered dentate stamp, and with a rounded castellation, upon the face of which is impressed scallop shell and dentate stamp designs. Figure 18, *a* is a vessel with rows of complex stylus punctate on the neck and oblique dentate stamp on the lip exterior and interior. Four chert and quartzite projectile points, all showing reject qualities,

with rounded tangs, side-notching and expanded convex base stems were found (Fig. 18, *l*). End scrapers were numerous, consisting of steeply chipped chert and chalcedony spalls (Fig. 18, n). Circular scrapers of the same materials were also present (Fig. 18, *m*). Knives were represented by various rough chert spalls and by three remarkably similar, crudely chipped oval pieces of slate, possibly ulus (Fig. 18, *k*). Two copper awls, both roughly formed by hammering, the larger laminated, were recovered (Fig. 18, *f*).

This Point Peninsula material correlates reasonably well with Point Peninsula foci 2 and 3 of western New York (Ritchie-MacNeish, 1949) while the earliest pottery types suggest correlations with Oberlander 2, Vinette 2, and Wickham I.

Primary Transitional Stratum

Superimposed upon the Point Peninsula deposits was a layer of dense black ash which displayed no visible stratification. Nevertheless the pottery had a threefold stratification. The lowest stratum, clearly separated at certain locations, was called Primary Transitional (Fig. 15). Four pottery types were recovered:

1. The diagnostic pottery has a uniformly brown, medium grit-tempered paste. The sherd, averaging 8 mm. in thickness, feels hard on the surface but displays weakness in the core and has a tendency to split. Both the interior and exterior are well smoothed and there is no evidence of coil construction. The standard vessel is collarless, flat lipped, vertical or slightly flaring from a constricted neck. Decoration consists of low castellations and large dentate stamp impressed obliquely and evenly from the lip well down the neck (Fig. 19). The flattened lip and the rim interior are also dentate stamped obliquely. In the interior, below the dentations, are one to three rows of holes, a result of round, oval or rectangular tools having been thrust through the soft clay, forming bosses on the exterior. These rimsherds reflect several Point Peninsula decorative features, especially Jack's Reef ones, which were applied to a new method of ware construction.

2. Figure 19, *e* is a buff colored ware, 5 mm. thick in the body but increasing to 11 mm. and is smooth inside and out with a flattened mildly everted lip. On both the rim interior and flattened lip, are poorly exe-

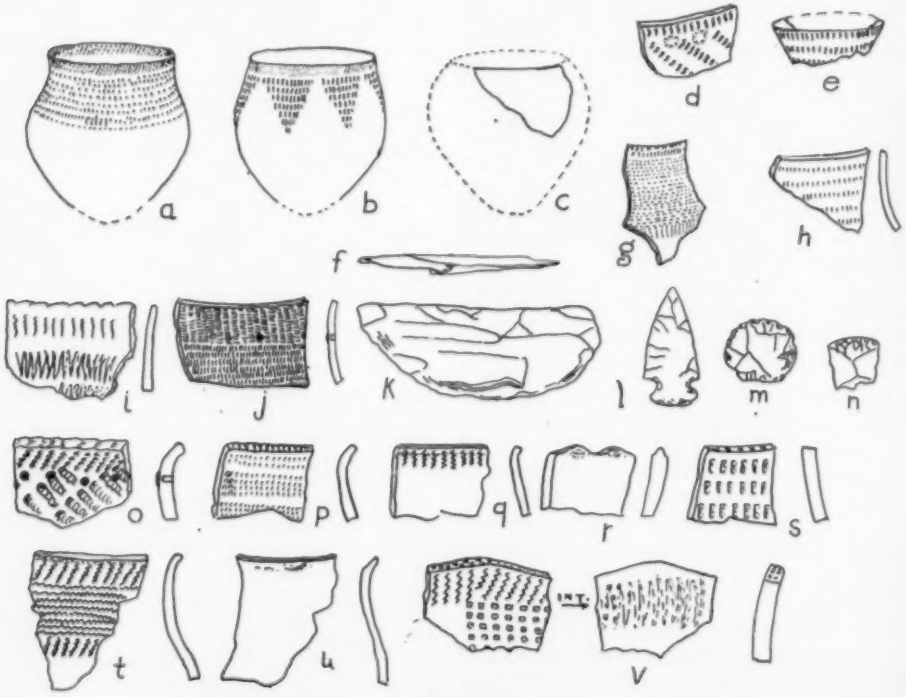

Fig. 18.

cuted short oblique incisions applied in a single row, sometimes concentrically.

3. Figure 19, *c* illustrates a hard, thin rimsherd with medium grit-tempering, light brown exterior and black interior and core, and an incipient collar 18 mm. high, punctated with a complex stylus; below the collar is a row of vertically applied corded-paddle marks.

4. Point Peninsula Corded Type (Fig. 19, *h*).

As yet no other material has been found in this stratum, the pottery of which suggests Point Peninsula 4.

FRANK BAY TRANSITIONAL STRATUM

This horizon was well defined in certain sections (Fig. 15). Pottery is also distinctive and in craftsmanship compares favorably with the best made in Ontario (Fig. 20, *c*, *d*).

Diagnostic sherds average 8 mm. in thickness, are medium grit-tempered, buff to predominating black, show no signs of coil construction, have flattened lips, flared and channeled collars, and short constricted necks from which straight to slightly convex shoulders descend at an angle of about 40° to intersect with round bottomed bodies. Two or more rounded or low pointed castellations are an integral part of the collar; one to three rows of bosses appear on the exterior base of the collar, accented by a deep punctate or incision between them which often takes the form of a dentate stamp applied vertically, obliquely or crisscross between bosses. On the collar, below the rounded castellations, there is hachuring of fine linear punctation; at the lip there are short, vertical punctates with fine linear punctation applied horizontally below to cover the balance of the collar. The neck or shoulder below the bosses is hachured all over with a complex vertical, horizontal or herringbone design of fine, linear punctations. The lip interior has oblique rows of dentate stamp well into the collar channel; on Figure 20, *d* it is executed with a complex dentate of Vinette style. Other vessels with bosses and the same essential shape have dentate stamp impressed obliquely on the collars, freely interspersed with linear punctation on the neck (Fig. 20, *a*, *b*).

The following were also recovered:

1. A group of sherds from a hard, dark vessel with overall cord or fabric marking (applied when the clay was extremely wet), interior bosses, and a flared, gradually thickened rim (Fig. 20, *g*, *i*).

2. A small number of lightly collared rimsherds decorated in a variety of ways, including a complex stylus punctate or corded punctate combined with poorly executed linear punctation (Fig. 20, *e*, *f*, *h*, *j*).

3. A low, globular pipe bowl with a simple design of two horizontal rings at the top of the bowl, underscored by a ring of vertical stylus punctations, and executed with a fine, complex stylus (Fig. 20, *l*).

4. A gray chert, side-notched projectile point with primary and secondary flaking and a straight-based tang slightly narrower than the blade (Fig. 20, *k*).

Frank Bay Transitional pottery has been reported by Wintemberg (1899, pp. 86-87) and Orr (1916, pp. 94-97) from Blenheim Township, Ontario, and by Ritchie (1949, pp. 10-12) from Rice Lake, although in the latter case cord marks replace the interior and exterior dentate decorations. A large rimsherd of this pottery was recovered by the writer from a shallow Point Peninsula deposit on Washburn Island, Lake Scugog; it included bosses at the base of the collar, linear punctation, crisscross and parallel dentate stamping, a check-stamped body and scalloped rim.

BARRIE-UREN STRATUM

In the upper and major portions of this extremely black layer (Fig. 15) were sherds related to those from the Barrie and Uren sites (Ridley, n.d.; Wintemberg, 1928), the latter

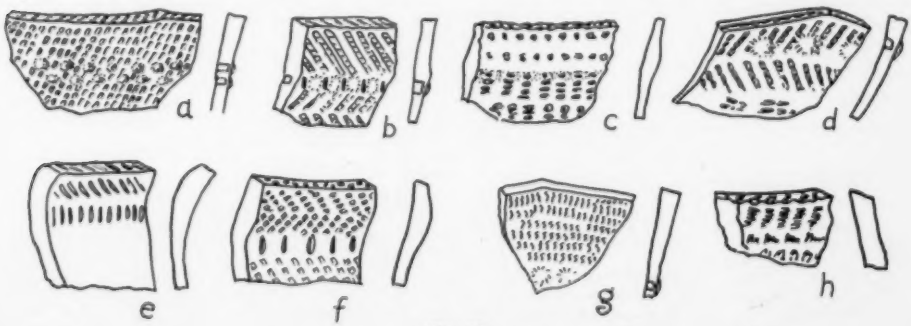

FIG. 19.

Fig. 20.

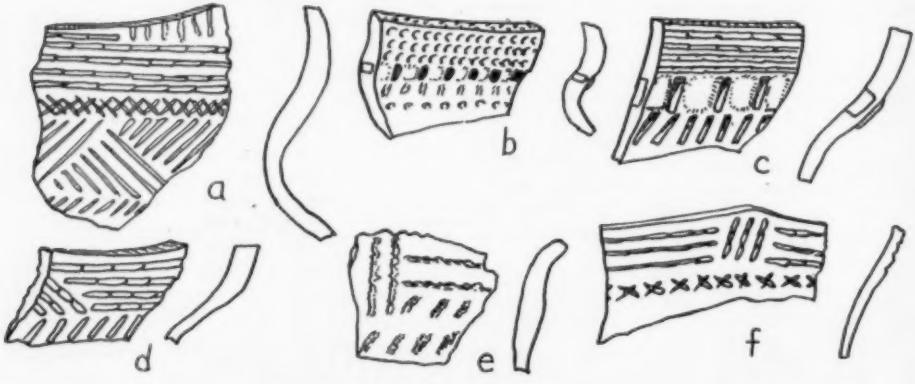

Fig. 21.

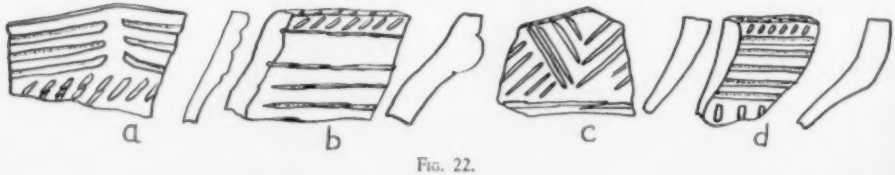

Fig. 22.

site containing the Frank Bay Transitional type as well, which was lacking at the former. Pottery at all three stations shares characteristics relating it to both the Frank Bay Transitional series just described and to the succeeding Webb-Middleport complex.

Diagnostic Barrie-Uren sherds found here are a progression from the principal Frank Bay Transitional ware: vessels have longer necks, short to elongated bodies, the latter often fabric-marked or cord-malleated, are fine grit-tempered, some 5 mm. thick, light to dark brown, and continue the decorative arrangements of their predecessor (Fig. 21). Rims are channeled and flared, in some cases with tentative punctates on the neck interior in the position of the boss holes found on the earlier vessels. Decoration consists of 3 to 5 horizontal lines of push-and-pull incising upon the collar, interrupted by similar vertical incising beneath three castellations. Oblique bands of push-and-pull incising interrupt the horizontal incising on some examples (Fig. 21, *d*). Below this may be a row of incised crisscross marks or bold vertical or oblique punctates, all apparently a continuation of the decorative boss of earlier vessels. A few sherds have the same design executed with impressed twisted cord; still others have complex punctations (Fig. 21, *b*, *e*). A rimsherd with a channeled collar and 3 lines of vertically elongated stylus marks applied obliquely, making vertical broken zigzags, is a continuation of the transitional types and seems to be a forerunner of Ontario Oblique (MacNeish, 1952b).

The secondary ware has a round body, poorly defined shoulder and elongated neck, averages 1 cm. in thickness, is medium grit-tempered, light to dark brown and remarkably friable, with a flat lip and channeled collar. Decoration consists of vertical or oblique incised lines under a castellation, a row of punctates or short, vertical strokes at the lip, several horizontal lines encircling the vessel, and below this a final row of short, vertical incisions. Much of the incising is poorly executed push-and-pull (Fig. 22, *c*, *d*). In a subgroup the horizontal lines terminate and start beneath the castellation, while the vertical element at the lip is omitted (Fig. 22, *a*). With both, vertical or oblique incising is sometimes present below the lip interior. Ontario Oblique with flattened lip, flared mouth, and rows of oblique, incised lines randomly placed, was also present.

Similarly with pottery of the type stations, pottery of this stratum has a degeneration of technique, in paste, burning, and the application of genetic ornamentation.

WEBB STRATUM

This stratum, which contained artifacts peculiar to the Webb and Middleport sites (Ridley, 1952a; Harper, 1952; Wintemberg, 1948), was neither extensive nor deep. It was largely blackened sand which stood out in marked contrast to the intensely black, carbonized deposits underlying it. However, where patches of Webb material occurred, they were above or mixed with secondary Barrie pottery and associated with Lalonde articles (Fig. 15), and physical stratigraphy was not clear.

The dominant ware was Webb Common (Ridley, 1952a) with thickened, flared rim and narrow lip incised with the decorative element of the secondary Barrie-Uren ware (Fig. 23, *c*). Figure 23, *cc* is one of several vessels restored by the writer from the Webb site (Ridley, 1952a).

In addition the following specimens were recovered:

(1) Sherds from a vessel with a medium high collar, incised its full depth with horizontal lines, and similar to ones on the Webb and Lalonde sites (Ridley, 1952a, trait 30).

(2) A finely made vessel with a complex incised and punctate decoration on the body (Fig. 23, *a*; *aa* is from the Webb site).

(3) A smooth, light colored trumpet pipe with annular lines incised below the lip, undercrossed with punctates (Fig. 23, *f*; also see Ridley, 1952a, Fig. 67, 35*a*; and Wintemberg, 1948, pl. 16).

(4) A large, exquisitely incised cone-shape pipe, (Fig. 23, *d*; also Ridley 1952; and Wintemberg, 1948, pls. 16, 17).

(5) Two flared tip mouth stems (Fig. 23, *e*; also see Ridley, 1952a, trait 40, and Wintemberg, 1948, Fig. 3, *b*).

(6) Small end scrapers made by retouching spall.

FIG. 23.

Conformity with Webb components include the similarly degenerative wares of the Barrie-Uren horizon and the appearance of fine clay vessels and pipes (Fig. 23, *a*, *d*) carrying the intricate zonal body decoration. The latter have design relations westerly (Wilford, 1945) and are discussed by Ridley (1952a, p. 207, trait 31) and illustrated by Harper (1952).

Lalonde Stratum

Artifacts of the Lalonde focus were widely distributed over the excavated area; this stratum was similar in appearance to that below it, the division between them being based solely on depth of artifacts (Fig. 15).

Fragments of four Lalonde high collar vessels were found (Fig. 24, *a*; compare with Fig. 24, *aa*, from the type site). A large Lalonde decorated body vessel (Fig. 24, *c*) compares with one from the type station shown in Figure 24, *cc*. The pointed castellation, many simple, obliquely incised rimsherds of thick, light-colored ware with notched rims (Fig. 24, *b*); rims with hachured triangles; oblique collar incising with underscored horizontal incising on the neck (Fig. 24, *f*); scalloped rimsherds (Fig. 24, *d*); and the finely made vessel of Webb Common type (Fig. 24, *h*) are all duplicated on the Lalonde site itself, and many other large components of this complex to the south (Ridley, 1952a).

In addition the following specimens were recovered:

(1) several barrel form pipes (Fig. 24, *i*) and related stems (Fig. 24, *j*).

(2) numerous end scrapers of retouched spalls.

(3) a side-notched chert point (Fig. 24, *e*).

This material is typically Lalonde and differs in no significant way from Lalonde material found to the south. From a site on Fisherman Island, about a mile from the Frank Bay site, S. Barley surface picked Lalonde type specimens, including high collar pottery and a trumpet pipe.

Contact Stratum

In the topmost 6 inches or so were European goods in association with native artifacts. Both the condition and position of these specimens suggested the effects of plowing and/or a log dump, evidence of both being present. Artifacts were relatively scarce.

Most of the pottery is from thin, hard, short necked, globular vessels (Fig. 25, *z*), with simple, oblique incising applied to short, flared collars (Fig. 25, *o*, *s*). The flat top variety of Contact Huron style castellation appears, but not in the large percentage relative to plain rimsherds found on historical sites in Huronia (Fig. 25, *q*). Several examples of decorated body vessels, with simple hachured triangles extending downwards in a single row from the shoulder angle, parallel those of the late Huron (Fig. 25, *x*; compare with Ridley, 1952, trait 31, Fig. 66, *16, 13c*). One sherd has an obliquely incised rim with notches at the base of the collar in typical Contact Huron style (Fig. 25, *p*).

Two wares differed from these distinctive late Huron types. There was a minor quantity of sherds from thicker, longer necked vessels with obliquely incised rims, one sherd has the flattened, unnotched castellation found on eastern Iroquoian prehistoric sites (Fig. 25, *w*). There were also sherds with narrow collars decorated with what first appeared to be oblique incising (Fig. 25, *t*, *u*), but on closer inspection turned out to have been executed by pressing a bar into the soft clay.

In addition the following specimens were recovered:

(1) several fluted, decorated pipestems, as well as round stems with bulbous tips, both characteristic Contact Huron types (Fig. 25, *j*).

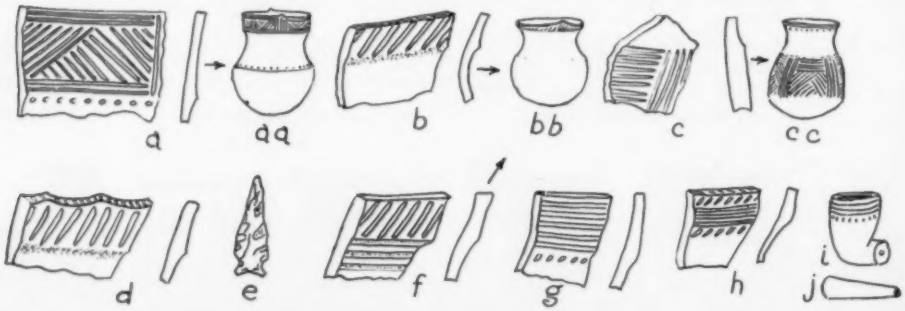

Fig. 24.

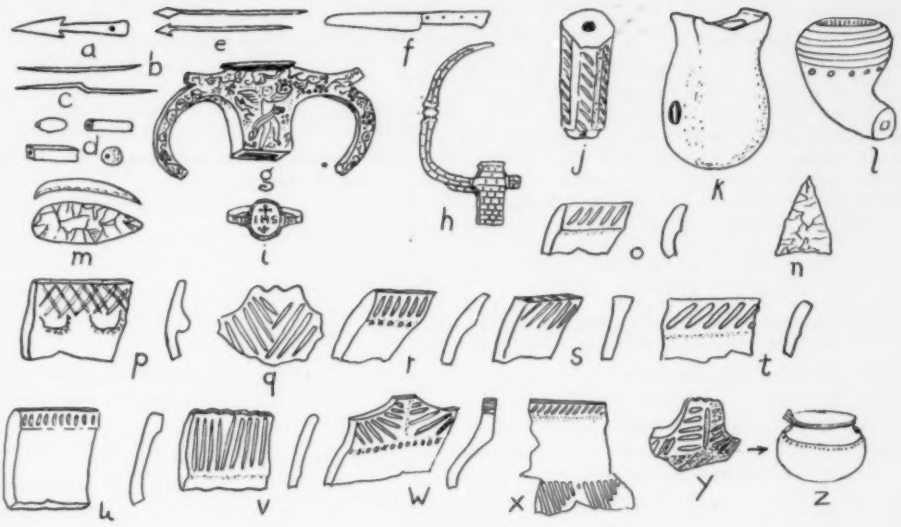

FIG. 25.

(2) vasiform stemless stone pipe (Fig. 25, *k*).

(3) fragment of a Huron acorn pipe bowl (Fig. 25, *l*).

(4) owl effigy pipe.

(5) many small triangular quartzite, chert, and chalcedony points of traditional Iroquoian pattern (Fig. 25, *n*).

(6) innumerable small polished opaque pebbles from 3 to 4 cm. in diameter, possibly rattle pebbles.

The European trade material equates with materials found on mission sites in Huronia, except the beads, which are predominantly white, and of football shape (Fig. 25, *d*). There were also iron and bronze sword and dagger guards (Fig. 25, *g h*), iron fish spears, fishhooks, bayonet fragments, knives and awls, 3 brass finger rings, 2 with the letters I. H. S. (Fig. 25, *i*); a kettle fragment with the large rivets of the handle bracket; and kettle scraps cut for re-use, including some made into bangles.

Three badly decomposed dog burials were uncovered.

There is both a published record (Globe, 1886) and oral tradition of the existence of a bone deposit or ossuary in this vicinity, possibly just inland from the site, but the nature of the deposit and possible connections it may have had with either this or another stratum here, remains unknown.

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THE GEOLOGICAL APPROACH TO DATING ARCHAEOLOGICAL SITES*

TROY L. PÉWÉ

INTRODUCTION

A BASIC QUESTION that must be answered for any archaeological site is, how old is it? Although some archaeological sites can be dated on the basis of archaeological correlations alone and although dendrochronological (Giddings, 1952, pp. 105-110) and radiocarbon methods give absolute ages for other sites, many sites can be dated only by methods based on the geologists' knowledge of geographic and climatic changes during the last few tens of thousands of years. The dates of these changes are established in part by radiocarbon and related methods. Study of archaeological sites accurately dated by radiocarbon methods will amplify the geologists' understanding of late Quaternary events.

The well known techniques of dendrochronological and radiocarbon dating need no discussion. The interrelations of methods that depend ultimately on our knowledge of Quaternary climatic and geographic changes are not always well understood, however, by archaeologists. The present paper is intended to clarify some of these interrelations.* *

REVIEW OF GEOLOGIC AND BIOLOGIC RESPONSE TO CLIMATIC FLUCTUATIONS

The Quaternary period of geologic time is characterized by a series of climatic changes reflected by fluctuations in the size of glaciers, in the position of sea level, in the regime of many streams, in soil formation, and in the distribution of vegetation and animals.

With world-wide cooling of climate, existing glaciers expand and new glaciers form. Water is stored in the form of ice in glaciers in sufficient quantity to cause a world-wide lowering of sea level. In many areas this results in emergence of the coast. Tectonic activity or isostatic adjustment to the load of glacial ice may, however, result in local warping of the crust, which masks the fall in sea level and locally may even cause submergence of the coast.

Regimes of many streams are changed by creation and expansion of glaciers in some areas, by the advent of more humid conditions in heretofore arid regions, by increased mass wasting in other areas, and by lowering of sea level in still others. Streams fed by glacial meltwater receive more sediment than they can carry; hence, they build up their flood plains. Other streams in cold regions fill their valleys because excess debris is supplied by more intense frost action and solifluction on the valley slopes. Permafrost may form near continental icecaps.

Large streams near sea coasts generally cut downward as their gradients are increased by lowering of sea level; small overloaded streams near the coast may aggrade, however, if lowering of sea level appreciably lengthens their courses (Hopkins and Giddings, 1953).

Winds are affected by climatic changes. Storm tracks migrate southward in the northern hemisphere, and near major icecaps anticyclonic winds are common. Silt is carried by winds from the broad, braided flood plains of streams fed by glacial meltwater and deposited on nearby uplands as loess (Hobbs, 1933; Tuck, 1938; Péwé, 1951). In arid and semiarid parts of the continents, such as the Basin and Range region of western United States, development of a more humid climate is correlated with glacial advances (Gilbert, 1890; Sayles and Antevs, 1941). Lakes expand and new lakes form, the water table is higher, and perennial springs and streams are more widely distributed. Soils formed during a humid phase are different from those formed during a dry phase.

The climatic changes affect plant and animal distribution. In the northern hemisphere the

* Publication authorized by The Director, U.S. Geological Survey.

** Special appreciation is expressed to D. M. Hopkins for assistance in organizing the paper and critically reading the manuscript. Archaeologists and anthropologists who kindly reviewed the manuscript and offered pertinent suggestions are as follows: J. L. Giddings, Jr., assistant professor of Anthropology at the University of Pennsylvania, F. H. H. Roberts, Jr., Associate Director of the Bureau of American Ethnology, W. R. Wedel, Curator of the Division of Archeology, U.S. National Museum, M. W. Stirling, Chief, and H. B. Collins, senior anthropologist, of the Bureau of American Ethnology and Otto W. Geist, Ivar Skarland, and J. Van Stone of the University of Alaska. W. S. Benninghoff and R. S. Sigafoos, botanists of the U.S. Geological Survey, contributed to the botanical and other aspects of the report.

forests shift to the south with the advance of continental ice. The northern hardwood forests are replaced by spruce, and in regions of severe climate the forest is replaced by treeless areas (Denny, 1951, p. 125). Tree line is lowered where the climate becomes more harsh. In formerly arid regions, with advent of more humid conditions, the lower altitudinal limit of forest growth may be lowered (Bryan, 1941, p. 56). Distribution of animals varies with change in environmental conditions, a reflection of climatic fluctuation. Warmth-loving animals migrate away from continental icecaps. During more humid conditions in areas that are usually arid, different types of animals appear. Changes in temperature of sea water caused by glacial advances result in a change of distribution of many aquatic animals.

Shrinkage and disappearance of many glaciers causes water to return to the ocean and sea level to rise. Again, in areas of tectonic activity or isostatic adjustment caused by removal of the ice load, changes in sea level are complicated by local crustal warping. Stream regime adjusts itself to changing climatic conditions. Streams near glaciers, or those that receive glacial meltwater, have excess water for the load carried. They are, therefore, able to remove part of the fill deposited during glacial advance; remnants are left as terraces. Frost action is less intense and mass wasting greatly reduced. In arid and semiarid regions, the warm phase is reflected by a lowering of lake levels, disappearance of many lakes and rivers, and a lower water table. Torrential rains cut deep trenches in the sparsely vegetated headwater valleys. Flash floods carry debris to the trunk valleys, where it accumulates because the trunk stream, with its more nearly normal flow, is incapable of removing it. During the dry phase, soil-forming processes are altered and leaching is minimized. Instead, water and dissolved solids are drawn upward by capillary action; and much water evaporates into the air, leaving a concentration of calcium carbonate (caliche) (Moss, 1952, p. 165). Streams near the sea commonly aggrade because rising sea level reduces their gradients.

Storm tracks are displaced poleward. Loess deposition decreases because of fewer braided rivers and outwash fans and because of the establishment of more vegetation. Forest belts shift northward in response to warming climate and the tree line rises higher on the mountains. Animal distribution again shifts; and ground-burrowing animals, formerly barred from some periglacial areas because of high permafrost table, now return with thawing of the ground. In arid regions some animals leave as the climate again becomes less humid.

In summary, climatic fluctuation causes changes in geologic processes and biologic ecology (Péwé, 1953). The changes vary with geographical position and other local conditions. Careful study is required to evaluate the climatic significance of geologic and biologic changes in individual areas.

The basic step toward geologic dating of an archaeological site is the construction of a chronology. A local geologic chronology must first be developed, but it has real value only if it can be related to the world-wide Quaternary geologic chronology. The chronology of the Quaternary period is best known and most studied in glaciated areas in North America and Europe (Flint, 1947) and provides a world-wide standard (Matthes, 1942, 1946; Manley, 1951).

Absolute dates for late Pleistocene events as determined by radiocarbon analyses are summarized by Flint and Deevy (1951) and Flint (1951b). Age estimates for older glacial stages, based on rates of weathering, are given by Kay (1931); estimates based on radioactive measurements are given by (Hough, 1953). In some places climatic episodes during the last 2000 years can be accurately dated by dendrochronology. Tree-ring study reveals small-scale climatic oscillations, some of which are reflected by recent glacier fluctuations or shifts in stream activity such as are recorded in southwestern United States by Hack (1942) and Leopold and Snyder (1951).

Dating of Sites

In the geologic method (Bryan and Ray, 1940, p. 2) of dating sites one tries to establish: "1, that the cultural objects are associated with a definite bed or beds; 2, that these beds are related to some definite geologic event; 3, that this event is related to other events or is of wide geographic extent; 4, that this event and related events are also related to some known geologic chronology." Geologic features used in dating are of two types: 1) stratigraphic and 2) physiographic.

STRATIGRAPHIC

Stratigraphic features are those inherent in the materials that make up a deposit such as a layer of volcanic ash, a fossil bed, or a caliche layer. Layers of sediments at a site may reveal differences in color, texture, structure, sorting, and mineral and organic content that are indicative of a series of changes of geologic processes (Moss, 1952, p. 164). Most dating is based on the examination of the stratigraphy of a site.

Pollen analysis (palynology)

The analysis of pollen and spore content of successive levels in peats and organic lake deposits provides a means of establishing at first local and eventually regional chronologies of past changes in vegetation. On the basis of some established facts and certain assumptions about the response of plant communities to changes in the environment, notably climate, chronologies of climatic change can be interpreted from the vegetation chronologies. Pollen grains are usually carried by the wind for no more than several miles before they settle out of the atmosphere. The more or less resistant waxy coats of fresh pollen grains are preserved when they are incorporated in accumulating bog peat or lake sediments. With nearly all vascular plants, form and ornamentation of the pollen or spores are constant for the species.

The techniques of pollen analysis (Erdtman, 1931; Cain, 1939) include identification and recording of 150 to 200 tree-pollen grains in each sample; and presentation of these data on graphs called pollen diagrams or pollen profiles. From such diagrams a competent plant ecologist reconstructs the indicated plant communities and deduces: (1) the character of the attendant physical environment and (2) changes in the environment to explain vegetation changes depicted by the diagrams.

A detailed vegetation chronology that extends back into Alleröd time has been established in northwestern Europe; but in the United States such a chronology is not yet well established. Unlike geologic chronologies, these records reveal more than individual climatic events or culmination points of long trends; the vegetation record is an index of continuous and gradual change in the environment, of which climate is a primary factor. At present, pollen analysis is the nearest approach to a single source for evidence of the continuous record of climatic changes in postglacial time.

As the glaciers retreated northward in North America, there was a definite northward migration of successively more warmth-loving vegetation in response to climatic amelioration. The vegetation types reached different geographical localities at different times so that spatial relations are involved in the correlation of local chronologies.

Pollen analysis is beset with many qualifying factors and limitations that are too often inadequately recognized. It is important to recognize the physiographic setting of the bog relative to glaciated areas. The bottoms of various bogs are not necessarily of the same age. This constitutes truncation at the bottom. A profile is said to be truncated at the bottom if it does not extend back in time as far as other bogs in the area. Also, a profile may be truncated at the top by cessation of deposition at some time in the past. A geologic study may disclose changes in sedimentation rate during accumulation of the deposit and that part or all of the pollen record is either telescoped or attenuated. Cognizance should be given to the suggestion that in cold climates frost-stirring of the upper sediments can disturb the finer details of normal stratigraphic sequences so that the pollen profile may lead to incorrect interpretations.

Cain (1939) points out that the analyst must be aware of the difficulty of identifying pollen of certain species; the differences of pollen production rates and pollen preservation; the difference of bog surface receptivity and possibility of differential pollen preservation; and the many purely local mechanical sources of error, such as contamination by pollen washing down along frost cracks (Godwin, 1934, p. 294). Random representation of grains in pollen counts are usually considered of little significance.

Sears (1938) states that general configurations of pollen profiles for postglacial time are due to climatic change; however, changes in composition of vegetation may be due also to topographical changes, soil development, biologic succession, and catastrophic factors such as fire, hurricane, or vulcanism.

In spite of all these qualifying factors pollen analysis is a valuable aid in establishing the climatic history of late Quaternary time.

In Europe many archaeological sites that occur within peat deposits or can be stratigraphically correlated with peat sections have been confidently placed in the local pollen chronology (Zeuner, 1950, p. 72-109; Godwin, 1934, p. 346-351). Pollen analysis has been little used in North America as an aid in dating sites but its potentialities have been noted (Sears, 1937; Eiseley, 1939). Two examples of the application may be cited. A buried fish-weir in Boston was discovered about 15 feet below present sea level (Johnson, 1942; 1949). The peat and silt associated with the deposit were subjected to pollen analysis and the age of the weir was tentatively placed at just after the postglacial thermal maximum (Benninghoff, 1942; Knox, 1942; Wilson, 1949). In a similar study in Oregon, Hansen (1942) recognized a warm, dry period, which he correlated with the postglacial maximum; a time when Lower Klamath Lake dried up and when early man established campsites on the lake bed.

Fossils

Another stratigraphic method of dating archaeological sites makes use of fossils. Associated with artifacts, they assist in determining the environmental and climatic conditions that existed during the occupation of a site; and more rarely they may indicate the order of magnitude of age of a site. This concept assumes that certain fossils have wide geographic distribution but limited distribution in geologic time, thus forming marker zones. The concept has only limited application in Quaternary chronology, however, because the time involved is short compared with that required for evolutionary change. Many living species have been in existence throughout Quaternary time. Other species survived throughout most of Pleistocene time but became extinct a few thousands of years ago.

The relatively recent establishment of molluscan faunal zones within late Pleistocene loess deposits of Nebraska (Leonard, 1952) may permit subdivision of loess deposits elsewhere in the United States and present archaeologists with a tool to date more accurately the artifacts associated with the loess. More careful search for these fragile fossils at archaeological sites in loess may prove fruitful.

Association of artifacts with extinct mammals, such as mammoth, mastodon, horse, bison, camel, and sloth (Sellards, 1940), indicates considerable antiquity; our knowledge of the former distribution and time of extinction of these animals is generally inadequate, however, to permit the use of them as index fossils in Quaternary deposits (Sellards, 1940, p. 410). Nevertheless, such fossils do give an order of magnitude for the age of the associated artifacts, an age that is readily available without detailed geologic study of the stratigraphy.

In Europe and in some localities in the United States, notably Nebraska (Schultz, Lueninghoener, and Frankforter, 1951), the Pleistocene deposits have been zoned tentatively according to their vertebrate fossil content. Many sites in Nebraska are tied into these zones. Future research may permit zoning of the Pleistocene deposits by use of fossil assemblages in other areas.

Fossils are most useful as indicators of past environmental, and thus climatic conditions in dating archaeological sites. These climatic indicators in turn are the basis for the geologic chronology. Climatic factors such as minimum winter temperature, depth to which the ground freezes, and amount of water available are limiting factors for many kinds of life. Burrowing animals, for example, are restricted by depth to the water table or permafrost, or depth of winter freezing, or by mean minimum temperature. Aquatic animals may indicate depth, quality, and temperature of the water in which they lived (Baker, 1937; Richards, 1937). These data are useful climatic clues for those who try to reconstruct past environmental conditions.

Fossil tapirs in arid southwestern United States indicate that a more humid climate existed in the past, and this factor was useful in dating the Ventana cave site (Haury, 1950). Miller (1946) has traced the former courses and positions of rivers and lakes in southern California and Nevada by a study of fossil fish. Fossil beavers in Pleistocene deposits west of the present western timber line in Seward Peninsula, Alaska, indicates greater extent of forests during a warmer period of time in the past (D. M. Hopkins, oral communication).

Patination on stone artifacts

An additional bit of evidence sometimes used in determining archaeological age is the degree of patination on stone artifacts (Skarland and Giddings, 1948; Carter, 1951, p. 301). This criterion must be used with caution be-

cause patination is known to differ with climate, type of exposure, and type of rocks as well as with age (Movius, 1942, p. 107).

Soil profile

A feature of many sites is an ancient soil profile, the paleosols of Hunt and Sokoloff (1950), that indicates a period of more or less stability interrupting periods of deposition or erosion. During this stable period weathering processes affect the ground surface, concentrating some elements in the soil and removing others. In relatively humid areas the upper soil layer (A horizon) is the zone of organic accumulation and clay depletion; the under layer (B horizon) is a zone of clay accumulation. In dry regions water and dissolved solids are drawn upward; calcium carbonate is deposited in the upper layer as the water evaporates. Care must be exercised in using ancient soil profiles because soils vary within short distances with variation in slope, drainage, vegetation, and parent material. A far greater thickness of organic material accumulates and a thicker, darker soil is formed in a poorly drained area than in an adjacent area on a 10 per cent slope. Generally speaking, the longer the period of stability and weathering, the thicker the ancient soil and the deeper the zone of weathering (Leighton, 1937). However, to evaluate the stratigraphic interval of weathering by comparing profile development of buried soils in one locality with that of soils in another locality, the soils in the various localities must have developed under similar circumstances (Scholtes, Ruhe, and Riecken, 1952, p. 299).

If used with caution, soil profiles may be valuable features for interpreting the local chronology. A soil profile is a record of the environmental conditions present when the soil was formed. Therefore, a buried profile may yield inferences about the past climate, vegetation, or topography of the area.

Fossil soils are used as stratigraphic markers in terrace fills of Nebraska in which many archaeological sites are found. By a detailed study of the loess and soils, a well documented chronology has been developed in which the sites are correlated (Schultz, Lueninghoener, and Frankforter, 1951, Fig. 9).

A thin ashy-gray to whitish silt layer is characteristic of the A_2 horizon of podzol soils. This thin horizon is quite striking and indicative of a period of stability; however, it is extremely easy to confuse this ashy-gray podzol layer with a thin whitish-gray layer of volcanic ash. Such mistakes have been made in central Alaska. Petrographic examination, which can easily differentiate between the two types of layers, was necessary in the Iyatayet site in Alaska (Hopkins and Giddings, 1953, p. 7).

Archaeological excavations of the great Kukulik mound on St. Lawrence Island, Alaska (Geist and Rainey, 1936, p. 45) revealed that the six cultural phases represented are separated by soil or sod layers, which indicate periods in which the mound remained unoccupied.

Moss (1951) has made excellent use of calcareous-rich sandy soils, along with a glacial terrace sequence, to date the Finley site in Wyoming. A thick layer of caliche, immediately overlying the artifacts is indicative of a period of intensive aridity, which Moss believes corresponds to the climatic optimum (postglacial thermal maximum).

On the other side of the world in Iraq, Wright (1952) approximates lengths of time relative to events in his chronology by the thickness and concentration of a zone of calcium carbonate nodules in the surface and buried soil profiles. He believes calcium carbonate is leached out of the surface layer by percolating ground water and reprecipitated below. This is only a crude indication of length of time because, as realized by Wright, he was not able to eliminate important factors that must be considered, such as differential primary carbonate in the soils, differential textures, and possible fluctuation in climate (written communication, June 29, 1953).

Frost-disturbed layer

In areas of present or past cold climates the culture layer may be associated with a zone of frost-disturbed material, or the culture layer itself may be disturbed by later frost action. Evidence of past frost action may be correlated with part of a known geologic chronology. This method has been used in Europe and recently at the important Cape Denbigh site in western Alaska, where the culture layer (Denbigh flint complex) was folded by solifluction after the relatively warm habitation period (Giddings, 1951; Hopkins and Giddings, 1953).

Varves

Varves are paired layers of sand, silt, or clay that are thought to be deposited, for the most part annually, in lakes receiving glacial meltwater; these paired layers have been valuable in estimating the rate of late glacial recession and establishing a late glacial chronology in Europe and North America. Although varves alone rarely give an absolute date for a site, they generally indicate glacial conditions and thus provide a clue to the past climate.

Varves played a vital role in dating the skeleton of Minnesota man that was found lying on varved silts deposited in a glacial lake (Jenks, 1936). Thiel (1936, p. 23) states, "The varves indicate that the silts were deposited below wave-base in relatively deep, quiet water. The thickness of the individual layers implies rapid accumulation and the texture of the sediment indicates that it was deposited near the ice front."

One of the most valuable uses of varves in post-Pleistocene dating is reported by Welten (in Deevey, 1946), who was fortunate to find in Switzerland a bog with varved gyttja.[1] The laminae were proved by a study of the type and amount of pollen in the individual layers to be annual.

The pollen profile yields an almost continuous record of about 10,000 years; and by counting varves, absolute dates can be given for any part of the pollen profile. Welten dates the beginning of the postglacial thermal maximum (climatic optimum) at 5400 B.C. using these methods.

Glacial deposits

Glaciation is the foundation of the Pleistocene chronology. The direct use of glacial deposits to date archaeological sites, however, is not common because most sites in or near glaciated areas are younger than the glacial deposits; if the deposits can be dated, they give a lower limit to the age of the site (Moss, 1951). It should be carefully noted that the presence of an archaeological site on glacial drift does not mean that the site is postglacial in the popular sense or that it is younger than the ice age or last major glaciation. Such evidence indicates only that the site is younger than the glaciation which deposited the drift upon which the site rests. Such a glacial deposit may be either older or younger than the last glaciation. Hopkins (1952) shows that such caution should be exercised in interpreting the age of the Anaktuvuk site in northern Alaska.

Chances of preservation of a site within or beneath glacial till are slim because of the destructive character of glacial advances. However, preservation within or beneath glaciofluvial or loess deposits is more likely. It is possible for outwash gravels to bury a site, although most sites associated with outwash gravels are found on top of such deposits. By tracing the gravels upstream to the associated drift, it is often possible to establish a lower age limit for the site.

Preservation of artifacts within or beneath loess is logical (Bordes, 1952; Schultz, Lueninghoener, and Frankforter, 1951) because the mantling eolian silt provides an excellent medium for preservation. One of the most celebrated finds in loess was that of half a century ago when the so-called Lansing man was found in loess in Kansas (Chamberlin, 1902).

Detailed study frequently reveals that with the aid of soil profiles, associated glacial sediments, fossils, and radiocarbon dating, the loess deposit can be placed in the proper position in the geological chronology (Frye, 1949; Péwé, 1952).

Dune sand deposits

The form as well as the stratification of most dunes is important in interpreting the geologic history, therefore, sand dunes could perhaps well be discussed under physiographic features instead of stratigraphic features that are important in the geological dating of archaeological sites.

Dune sand deposits are a common feature in presently or formerly arid or semiarid regions or glaciated regions and offer a great deal of information on past environmental conditions. Such deposits may give data on changes in velocity and direction of winds, on precipitation, on depth to water table, and on distribution of vegetation.

At the San Jon site in New Mexico, Judson (1953, p. 13) demonstrates that during an arid period sand dunes were deposited and during

[1] "Gyttja is sediment largely consisting of remains of plants and animals, as vascular water plants, algae, crustaceans, molluscs, etc., and of excrements" (Antevs, 1925, p. 5).

a moist period a soil layer was formed on the sand and water collected in depressions because of a higher water table. Return of arid conditions enable windblown sand to bury the earlier sand dunes and the soil layer. This stratification is similar to the sequence described by Moss (1951, p. 35) in Eden Valley, where three superimposed windblown sands are separated from each other by two ancient soils. The windblown sand is said to indicate arid periods during which the water table was lowered and the vegetative cover changed, permitting transportation of sand by the wind. Three windblown sand deposits and associated weathering zones are used by Bryan and McCann (1943) in establishing a chronology to date artifacts found near Grants, New Mexico.

Volcanic ash

The instantaneous nature of volcanic ash deposition and its widespread geographic distribution may make an ash layer a valuable key bed in dating deposits. Caution must be used in high latitudes and altitudes to differentiate a thin volcanic ash layer from the A_2 horizon of a podzol soil profile. A site can be dated if it is associated with an ash bed that can be correlated with known geologic events. The Mt. Mazama (Crater Lake) eruption in Oregon, estimated by Williams (1942) by rates of erosion, pollen analyses, and extent of former Mt. Mazama glaciers to be 4000 to 7000 years ago, scattered pumice over archaeological cave deposits. This established the upper date for the age range of these deposits (Cressman and Williams, 1940). The date for the ash deposition has been borne out by radiocarbon analyses, which place the eruption at 6,400 years ago (Heizer, 1951, p. 23). Volcanic ash layers have been used as a basis for a chronology (tephrochronology) to date archaeological sites in Iceland (Thorarinsson, 1949).

Physiographic

Physiographic features reflect the development of the landscape in the immediate area of the site, such as the filling and cutting of a valley or the rise and fall of lake level.

At many sites the culture layer can be shown to have formed under topographic conditions that no longer exist. This fact alone generally implies considerable antiquity, but it is of more value if the past topographic conditions can be fitted into the geologic chronology of events and a position in time ascribed to the culture layer (Bryan and Ray, 1940).

Terraces

Cultural deposits commonly are found on the surface of terraces. Some sites can be demonstrated to have been occupied at a time when the surface of the terrace was part of the valley bottom (Hopkins and Giddings, 1953, p. 8). The changes in stream level may be related to changes in sea level or to changes in stream regime due to climatic changes. The age of the site may be inferred if these stream level changes can be related to a known geologic chronology (Anderson, 1932).

One of the ideal relationships for the geological dating of a terrace, upon or within which artifacts may be located, is the definite association of the terrace with changes in glacial regimen. Upon tracing a particular terrace upstream it may be found to terminate at a well-developed glacial end moraine. It is evident that the stream alluviated its valley during glaciation, but with retreat and diminution of the ice, the stream cut down, leaving the alluvial deposits as terraces on the sides of the valley. In many glaciated valleys of the world, as successive glacial advances terminated closer and closer to the ice source, the terraces formed at lower and lower elevations and extended farther and farther upstream.

This relationship is excellently shown along the Nenana River in the Alaska Range (Wahrhaftig, 1953). It is also well developed in the Eden Valley of Wyoming, where Moss (1951, pp. 67-76) demonstrates that the Finley site is associated with a terrace that can be traced to a prominent end moraine. The site is therefore the same age or younger than this end moraine, a moraine whose position in the broad glacial chronology is well known.

The famed Lindenmeier site in Colorado has been dated by the geologic study of terraces and associated glacial moraines (Bryan and Ray, 1940).

Another set of terraces that generally can be tied into a known chronology are marine terraces formed during the Quaternary fluctuations of sea level. Such terraces or beaches have been used by Carter (1952) in his study of early man in southern California and by Movius (1942) in Ireland.

Sea and lake levels

A site of human occupation is found on an island in Cayuga Lake, N.Y. This site could not have been occupied until after the island emerged when parts of the glacial Great Lakes were drained. This indicates the maximum possible age of the site (Flint, 1951a, p. 6).

If a group of sites of the same type is found on an abandoned shoreline and if no sites of this type are found within the former lake basin, it may be assumed that the occupation was contemporaneous with the shoreline (Campbell, Antevs, Amsden, Campbell, Barbieri and Bode, 1937, p. 42.) However, caution must be exercised. Abandoned beaches form excellent campsites in some localities because they are dry, easily accessible, and command a view of the surrounding countryside. Evidence of a culture based on fishing or other seagoing activities support the assumption that the sites were contemporaneous with the shoreline.

Perhaps the most extensive use of an old raised beach or abandoned shoreline in dating archaeological sites is shown by the thorough work of Movius (1942) in Ireland. Movius fits the archaeological succession of coastal Mesolithic sites into the geologic chronology, a chronology built mainly around the transgression and subsequent regression of the Litorina Sea with subsequent formation of beaches and beach deposits.

Some knowledge of the degree of antiquity is established by observing that a site lies below present sea or lake level. The Boylston fishweir in Boston, for example, lies about 15 feet below present sea level. Radiocarbon age determinations demonstrate that this site is about 4500 years old (Barghoorn, 1953, p. 598).

Even in determining antiquity by observing the height of a site in relation to present sea level, caution must be exercised, because a shoreline may be sinking rapidly, recently pointed out by Barghoorn (1953) at Saugus, Massachusetts.

The archaeological chronology established at Gambell on St. Lawrence Island, Alaska, by Geist in 1929 (Geist and Rainey, 1936, p. 32) was first suggested by the arrangement of the middens in relation to the shoreline of the gravel spit on which they are found. As the gravel spit grew larger and larger, the village was left farther and farther from the sea. To compensate for this growth of the spit, villages were successively abandoned and rebuilt nearer the sea. The position of the oldest midden, now three-quarters of a mile from the sea, is some indication of antiquity of this former village (Collins, 1937, pp. 251-56).

Water supply

The antiquity of a site is sometimes suggested by the source of the water supply that existed at the time of occupation. It may be shown that the source of water was a spring, stream, or lake which has long since migrated to a different position or completely disappeared. An old Indian site near Kenai, Alaska, suggests its antiquity by its position many miles from present water supply but close to an old filled lake basin (T.N.V. Karlstrom, oral communication).

Conclusions

The geologists' knowledge of the geographic and climatic changes during the last few tens of thousands of years is especially valuable in dating archaeological sites. By careful study, it generally is possible to evaluate the climatic significance of geologic and biologic changes in individual areas and to construct a geologic chronology — the basic step toward geological dating of an archaeological site. This chronology is valuable if it can be related to the world-wide Quaternary chronology.

Some of the geologic features that aid in constructing a local chronology are pollen analyses, vertebrate and invertebrate fossils, weathering of artifacts, development of soil profiles, frost-disturbed layers, varves, glacial deposits, sand dune and loess deposits, volcanic ash layers, terraces, and raised or submerged beaches.

All possible evidence should be examined and many lines of geological attack followed in an attempt to date an archaeological site. In the Tepexpan area in Mexico, for example, it was possible to use three different types of geologic stratigraphy: glacial, alluvial, and lacustrine (De Terra, Romero, and Stewart, 1949, p. 51). In addition, radiocarbon dating has been used to verify the results of these interpretations (De Terra, 1951, p. 33-34). A notable example of a multiple approach to the dating of an archaeological site was the Boston fishweir, where geologists, botanists, biologists, chemists, and archaeologists combined their efforts.

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November, 1953

FACTS AND COMMENTS

A NEW TYPE OF ARCHAIC RUINS IN CHIAPAS, MEXICO

This report outlines the discovery, in 1953, of ruins in the state of Chiapas, Mexico. In ground plan, architecture and construction these ruins, so far as I can determine, show no obvious relationship to old empire Maya ruins some 100 miles to the east. Neither do they exhibit easily identified similarities with the Valley of Mexico sites.

The ruin most thoroughly studied consists of a 200 by 680 foot integrated rock complex of very squat structures inclosed by a low wall or rampart. No structures exceed 15 feet in height. The commanding elevation of the complex was obtained by building in on top of a great, field-rock mound, which in turn was built on an elongated natural hill. At the base the mound is approximately 700 feet long, with a varying width between 300 and 400 feet. In one place, on the south side where the hill was indented, the mound is approximately 70 feet high. Its average height is probably about 25 feet.

The builders utilized multiton, weather-formed boulders lavishly in foundations and supporting walls. Some of them have been rough-squared. Structures and the rampart are built of, or faced with, rough-squared limestone slabs. A size of between 3 and 4 feet square by 8 to 10 inches thick appears to have been almost standardized.

No structures appear to have been built with inward sloping sides. All have parallel sides. Height was obtained by erecting a smaller structure on top of a larger one. This gave a stepped-back effect. None utilized more than one such step. None appears to have exceeded 15 feet in height, although two have respective widths of 25 and 45 feet and are 100 feet long. Six ruins of this type are spotted over an area of approximately 800 square miles. Others reported by *chicleros* may extend it to the north and northeast.

The sites most accessible for study lie in a deep, narrow valley between 15 and 20 miles northeast of Piedra Parada, which was excavated by Stirling in 1944. Because the valley is protected by a range of towering mountain peaks the ruins have not been subjected to high winds and driving rains. They are in surprisingly good condition. The valley, which has a very prolonged rainy season, is heavily overgrown with rain forest and cannot be worked effectively for more than three months in any year.

The valley holds three very extensive, integrated complexes, two of which I measured and photographed as thoroughly as conditions permitted. They are only 600 feet apart. The largest, which measures 600 by 800 feet, appears to be the oldest. I will refer to it as complex No. 1. No. 2 is the one referred to in the preceding paragraphs. A third lies 8 miles north of No. 2. I was unable to measure or photograph it because of rain. I did however, spend 10 days at No. 2. Figures given are the result of steel tape measurements. When qualified by "appear to be" or "approximately" the reader can assume the structure referred to had been badly wrecked by trees and their root systems.

This complex is built upon a large foundation-mound of piled field rock and is oriented almost east-west. The north side of this mound slants up to a massive vertical wall upon which the complex stands. This wall is built of large, weather-made boulders some of which are multiton. A few appear to have been roughly-squared. Because the complex floor rises in a series of four levels, the height of this supporting wall increases from 15 to approximately 50 feet. It is 650 feet long.

The hill upon which the mound stands drops away abruptly at the mound base on its north side. Since the angle of the sides of an uncemented, piled-rock mound must be relatively flat to assure permanent stability, and the base width could not be increased, the builders were faced with the problem of whether to keep the mound relatively low or content themselves with a very narrow floor space for their complex. They did neither. Holding the north side of the mound to a safe angle they stopped at the height which would give them the 200 feet width the complex now occupies and built straight up with a ponderous wall. Thus they obtained both height and width. No such problem faced them on the south side. There the mound is piled rock from base to complex floor. While predominantly field rock it is studded with weather-made boulders, some of them weighing in excess of 10 tons. Consistency of architecture and construction indicates that the entire unit represents uninterrupted construction built to a preconceived plan. Its builders' knowledge of rock carving was apparently limited to rough-squaring of limestone slabs. Diligent and prolonged search of the complexes failed to locate a single carved petroglyph, carved stele or monument or any artifacts of worked stone.

This makes it appear that the culture probably flourished prior to 300 B.C. The Maya site of Tonina lies only 150 miles away. Other lesser Maya sites lie even closer.

On the north side of the complex its low rampart is broken into, at irregular intervals, by structures. They are approximately 25 feet wide and vary from 30 to 70 feet in length. They vary in height from 8 to 15 feet. One is built in two tiers. The rampart itself averages 10 feet in width and apparently maintains a height of 5 feet all around the complex.

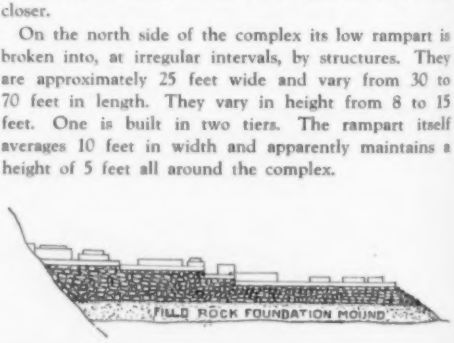

FIG. 26. Elevation of complex No. 2 showing great north wall.

All structures have what appear to be entrances on their inboard sides. Trees have collapsed all but one of them. Most of them appear to have been permanently closed and may have been purely ornamental as were the windows in the Piedra Parada ruins excavated by Stirling. The one still open, or possibly reopened, has stone steps leading down into a four-foot square, roofed, vestibule. From it a 14-inch-wide doorway leads in under the structure. The top of this doorway is almost two feet lower than the complex floor. The vestibule and doorway are now filled with earth and rocks. Because this fill contains many sherds, I believe it was placed there deliberately and is not the work of time and the elements. This entrance, which I used as a shelter during the nights I spent alone on the site, can be excavated easily. Structures and the rampart were originally faced or capped with rough-squared limestone slabs and have field-rock fills. Two are walled with slabs laid flat and may have inner chambers. Their collapsed entrances appear to lead down below the level of the complex floor. All structures have parallel sides.

It is difficult to avoid the conclusion that this complex may have been the mausoleum of an important personage.

The lowest level of the complex floor shows flagstone paving under the earth and humus. Sounding it with a length of hard wood produced a booming sound at two separate points on its north side.

South of complex No. 2 the valley floor drops in a series of two natural tiers. They are heavily forested. On one level I located many weather-formed boulders, several of which appear to have been roughly squared. They are stacked in wall or foundation form 3 or 4 high. None of these walls complete a recognizable pattern but occur in short, disconnected sections.

I believe they are what remains of a very ancient construction which was robbed to build complex No. 2. The presence of similar boulders in the complex mound and its great north wall strengthens that supposition.

Complex No. 1 lies 600 feet north of No. 2. Stepped measurements show it to be approximately 600 by 800 feet. It is oriented north and south. Because of time and supply limitations, I was able to measure and photograph only one corner of it. I did so because the corner holds an erect, unworked rock slab which is almost identical to the one for which the Piedra Parada site, worked by Stirling, was named. This piedra parada, or standing rock, is slanted due north.

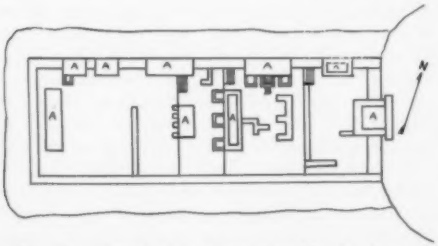

FIG. 27. Ground plan of complex No. 2. A — structures; B — intact entrance.

Except for three low, round walls or foundations, the construction measured is the same as in complex No. 2. Two of the round walls are 10 feet in diameter. The third one is 20 feet. There are sections of massive, weather-made boulder walls along boundaries of the complex. There they serve as base-retaining walls for a very long and high fill or mound of field rocks. The fill or mound contains many multiton boulders.

The complex is densely overgrown but appears to have been built on natural hills which were squared off and filled so as to form different levels. It contains many piled-rock mounds with rough-squared limestone slabs lying about in profusion. I also noted several rough-squared limestone slabs which measured 4 by 6 feet and were one foot thick.

The west side of the corner I measured contains sunken court. It is reminiscent of the ball courts used by the Mayas, but is much smaller. It measures 15 feet by 150 feet. An eight-foot high structure which is 30 feet long and 15 feet wide forms its west boundary. This structure is made of piled field rock faced with rough-squared limestone slabs. A curious feature of it is the four four-foot niches built into the side which faces the court.

The only year around water supply in the area is a pool which becomes very stagnant during the months of minimum rainfall. It lies a short distance north of complex No. 1. A deep, circular depression which was once a laguna or pond lies between the two complexes. Another lies south of complex No. 2. Both of these depressions now funnel down into yawning sinkholes. I believe this indicates that subsurface limestone stratum dissolved, allowing two once dependable water holes to run dry. An elongated, piled-rock mound or landing extends to the waterline of the stagnant pool. Exploration may reveal similar landings at the dry holes.

A level area north of an Indian house on the west rim of the valley holds a large but undetermined number of low, round, piled-rock mounds. They are heavily overgrown and I did not attempt to count them, but my Indian guide says they number over 40. I have employed him on each of my three trips into the same general area of Chiapas and always found his statements surprisingly accurate.

Square, round, and rectangular, piled-rock mounds are very numerous along the approach to the valley and in the country around it. Many of them are simple rock piles, but some of the square and elongated ones have their bases faced vertically to a height of between 3 and 4 feet with unworked but carefully selected field rocks.

Whether these mounds represent different cultures or are progressiye stages in the culture I measured remains to be determined.

The entire area is liberally dotted with caves. Those I visited are carpeted with sherds, in one to a depth of

over one foot. This suggests that the caves were used for religious rituals over a very extended period.

I made my base in the valley of the ruins called Piedra Parada which Stirling excavated. From there to the complexes I have described requires a full day on horse and afoot. The trail is so steep and rocky that it is often necessary to dismount and allow the horse to scramble up or down unencumbered by a rider. This, and the fact that the builders of the complexes utilized such ponderous slabs and boulders, makes excavation and study of them a formidable problem.

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PRECLASSIC METAL?

The usually accepted earliest date for metal objects in Mesoamerica is the 8th century A.D. (Copan and Tazumal). There are, however, two occurrences reported in the literature which seem to have been ignored despite apparent ages much before this.

One is reported found by Cummings at Cuicuilco in 1924-25. In part his account reads, ". . . resting upon the top of the horseshoe-shaped walls were the fragments of a copper wand that had been made of thin copper plate hammered around a wooden core and held together by copper nails. Some of the charred remains of the wooden core still clung to the copper plate." The stratigraphy is somewhat difficult to follow in the account, but it appears that the find dates between the last stone construction and the volcanic action which partly covered the site. The spot was overlain by a uniform layer of yellow sand and clay and above this, "surface loam with traces of ashes and carbonized material at the bottom," a total of at least 7 feet of soil. Cummings speaks of the copper as "crude." It is uncertain whether the term was used in a metallurgical sense. If the object can now be located, a metallographic examination should be made.

The other find is reported by Smith (1944). A group of privately-owned and amateur-excavated artifacts was examined by him in San Miguel Ixtahuacan, Department of San Marcos, Guatemala. Included with eleven ceramic vessels was a piece of sheet copper which, it was reported, had been found inside one of the vessels, all the pieces coming out of a single mound. Smith's description and analysis of the pottery shows it most probably to belong to the Proto-Classic (Holmul I). His concluding remark was: "In view of the above (the definitely Proto-Classic features in the ceramics) and of the absence of any piece of known late type, I am inclined to doubt that the scrap of copper was found in association with these vessels. If such was actually the case, they would have to be assigned to a relatively recent period." No objective evidence was presented to justify a date later than that indicated by the pottery.

May this prove to be a case similar to the wheeled toys that went unnoticed for years? Have there been other finds of metal in early context which have not been reported, following Smith's reasoning?

We can at least agree with Kroeber's statement (1940) that, "When we shall have more, and more exact, data on this Mexican metallurgy, it is quite likely that its South American origin will be confirmed. For the present however, it seems wise to remember that we have only preliminary indications, and that full data might conceivably write an entirely new story."

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INDICATIONS OF A PALEO-INDIAN CO-TRADITION FOR NORTH AMERICA

It is time to consider some recent trends in thought on the paleo-Indian and certain inferences which may be derived from trait evidence so far discovered. Recently, some specialists on the problem have begun to realize that, although a good number of flaked blade types from the "early man" horizon have been found scattered over North America, there are also certain associated artifacts which bear significant similarities over a continental area. Thus, the idea is taking shape that the paleo-Indian here was not represented by many culturally diverse groups, but was, on the other hand, living perforce in a relatively culturally homogeneous manner since he existed on much the same economic base for several thousand years. Although different techniques and fashions of artifact manufacture were developed, these changes did not necessarily indicate change in a mode of living.

In discussing the western area with reference to Danger Cave, Jennings (1953) proposes that many of these "early man" manifestations could be lumped together as the Desert culture. Daugherty (1953), in his report on archaeological salvage operations in the state of Washington, writes "The material from the Lind Coulee Site points to its inclusion within a generalized early cultural manifestation in western North America."

The eastern portion of the continent also manifests artifact traits of paleo-Indian peoples roughly contemporaneous with those in the West. Goggin (1949) has

stated that the paleo-Indian tradition is "A distinctive way of life, reflected in various aspects of culture, extending through some period of time . . . sharing a basic consistent unity. In the whole history of a tradition, certain persistent themes demonstrate the life of the people. These give distinctiveness to the configuration."

So, the suspicion is now rife that the paleo-Indian did manifest certain persistent themes in his manner of living. He was by trade a hunter of migratory herbivore game which, in turn, was dependent for the most part upon pluvial conditions for its survival. His distinctive cultural configuration was determined by this mobility —his tools were portable, often being carried far from their raw material origin, and his housing sufficiently modest to disappear virtually without a trace.

What, then, is really significant about the identified artifacts of the paleo-Indian? An artifact tradition with implied economic and social traits having perspective in time and space begins to take shape. Consider the beveled bone foreshaft portions or spear tips which were first reported in association with fluted blades and extinct game animals at Clovis (Cotter 1937 and 1938), and subsequently have been recovered in contexts indicative in varying degrees of pluvial association at Lower Klamath Lake, Oregon by Cressman (1942); Daugherty (1953) at Lind Coulee, Washington; Jenks (1941) in the Itchtucknee River, north-central Florida; and Rainey (1939) at Coldstream, Tanana Valley, Alaska. Ever since he participated in the original Clovis find, the present author has considered these beveled shaft portions of bone to be derivative from the familiar *sagaie* or javelin points of bone or reindeer horn from the traditional lower Magdalenian of Europe. It is not difficult to assume the spread of this upper paleolithic trait across Siberia into the New World, allowing for an expected cultural lag while the trait remained in the arctic regions of the old and new world before dissemination into North America after the last glaciation.

Next comes the fluted blade, under a host of more or less obfuscating type names, with a distribution comparable to that of the beveled shaft parts, from Alaska to Florida, but with representation throughout the entire United States and the provinces of Canada. Another group of artifacts, equally characteristic in the eyes of specialists, and of wide, though less comprehensive, distribution, are the erstwhile Yuma points, now broken down into the somewhat vague and sometimes overlapping types designated Plainview, Eden, San Jon and Scottsbluff. Add to these the Pinto Basin, Gypsum Cave, Manzano and one or two other blade types which appear to fit into the Pluvial and early post-Pluvial faunal and geological associations.

Finally, there are the more universal, and therefore less readily recognized paleo-Indian traits which were carried on among hunting peoples into the historic era. These are the scraping, cutting, piercing and smoothing tools of stone and bone, representative collections of which have been reported from various paleo-Indian sites. It is especially notable that this class of tools shows little variation whether from sites in Pennsylvania or Virginia or Colorado, so that closely comparable ways of life are indicated for paleo-Indian components of widely-separated areas. Likewise, simple grinding tools consisting of small netherstone and hand stone were present long before the advent of seed culture.

In the Southwest, however, as the anathermal progressed, elements of paleo-Indian culture would logically have followed the large herbivores to the north and east, while those remaining would, by the advent of the altithermal and the termination of the large herbivores as game, have been forced by ecological conditions to adopt a primarily gathering economy which looked forward to the inception of a proto-Basketmaker economy. Wormington (1949) has sensed this when she concludes her observations on stone industries with the statement that early Cochise and other cultural manifestations postdating the fluted blade industries indicate that "there was a pattern based essentially on food gathering as well as one based on hunting in very early as well as in later times." By the same token, the paleo-Indian of the Southeast may have been obliged to turn his attention to gathering river molluscs, ultimately abandoning some of his specialized hunting tools and anticipating the traditions of the archaic.

Roberts (1953) has pointed out that, area-wise, the traditions of the paleo-Indian break down into local lines of development which, although an essentially similar economy is implied, produces variations in the types of artifacts, notably projectile points. Such local development was no doubt inevitable, even in relatively uniform ecological conditions, and despite comparative mobility of the hunters, because of the vastness of the continent. Some such regional characterization of artifact traits is evident in the desert and fossil lake area of eastern California, including the Pinto and Mohave basins; in the deserts of southern New Mexico, southern Arizona, and northern Mexico; in the southern Great Basin country of northeastern Mexico; in the northern Great Basin country of northeastern California-Oregon-Utah.

Regional variations likewise appear in early sites of Alaska, where certain paleo-Indian traits may be intrusive (Giddings 1951), and in the Canadian plains, as in the eastern woodlands and savannahs; but again, the ensemble of artifacts has much in common with the paleo-Indian tools of the Great Plains. The fluted blade and to a far more restricted degree, the unilateral-stemmed Sandia blade, are relatively early developments in North America, but the fluted blade is the only form truly peculiar to the western hemisphere, where its development on a typological basis is strongly indicated. The older Sandia blade is as close to European Solutrean forms as to anything subsequent in America.

Having sketched briefly paleo-Indian cultural indications as they are now known, let us consider the concept of area co-tradition to see if it may be applied usefully in this instance. Admittedly, there is lacking much

of what we should know about the subject, but the great temporal depth and enormous area spread of the essential traditions involved is now apparent.

Although Bennett (1948, p. 1) began his original definition of the concept of area co-tradition by characterizing it as "a culture area [with] time depth," his interpreters since then will brook no such disarming simplicity. Rouse (1954, p. 221) formulates the concept as an ethnographic culture area which can be projected back into prehistory by the following criteria:

"1. Its extension through space and persistence in time are great enough so that it can be divided into series of both regions and periods.

2. Its cultural characteristics occur in all of these regions and periods."

With this concept Rouse associates characteristics which may be summarized as follows:

1. These cultures are found in all the regions into which the culture area has been divided during each period of its existence.

2. The cultures which succeeded each other in time are linked together by a series of traditions.

3. Some of the cultures which were contemporaneous are similarly linked together through space by a series of traits which tended to diffuse from one culture to the rest.

If the co-tradition concept is visualized as tailored precisely to Peruvian measurements, considerable alterations must be made before it will fit elsewhere. Yet Willey (1953, p. 374) has suggested a possible Arctic co-tradition, and, for the Eastern United States, Archaic, Woodland and Mississippian co-traditions. The concept of a paleo-Indian co-tradition takes shape when we visualize basically similar traditions continuing with minor technological variations over a time span of many millennia throughout the New World. Let us adapt the concept as follows:

1. The cultures comprising the co-tradition which occur in all the regional subdivisions of North America during all its periods of existence may be taken as the paleo-Indians who used spears, atlatls, or both, and hunted large herbivores, employing a wide and almost universal gamut of skinning and hide-working tools.

2. These cultures may have succeeded each other in time, such as the Sandia, the Clovis and Folsom, the San Jon and Manzano, to cite a possible temporal series. At the same time they are linked together by their essential hunting traditions.

3. Again, some of the paleo-Indian cultures which were approximately contemporaneous, such as that of the composite bone shaft and fluted blade makers of the high plains and those of the eastern savannahs, were linked through space by traits which tended to diffuse with only minor changes and over a huge area.

4. Finally, when the various paleo-Indian cultures comprising the co-tradition are laid out according to their distribution in time and space, they reveal the same general stages of development appearing at approximately the same time in all regions where the co-tradition occurs. Here we must make a distinction: First we do not know for sure if the earliest culture, perhaps that at Sandia cave, had a contemporaneous identity elsewhere in North America. Probably this early manifestation did not. This premise, however, would probably hold for the fluted blade makers, less certainly for the Eden-San Jon-Plainview blade creators, if a true distinction actually exists for the latter three as distinct traditions. But if any degree of contemporaneity can be established for the beveled-composite bone shaft users, this will be a solid contribution to the concept of a paleo-Indian co-tradition. Drawing a negative inference, we can say that we know of no culture in the entire spatial range and time span of the postulated paleo-Indian co-tradition which did not participate in a general trend of cultural development.

Rouse (1954, p. 222) has pointed out the unique quality of the Peruvian co-tradition, in that here a diffusion of culture has been effected through the spread of traits from one local group to another by trade or conquest. However, if the concept of co-tradition is to become sufficiently flexible to be applied beyond this peculiar situation, we may envision it to pertain to mobile groups which diffused their culture over a continent, then developed local traditions which were strongly linked in the design and purpose of economic and artifact traits.

The simile of a piece of cloth — Peruvian cloth — has been used by Rouse to illustrate Bennett's criteria of co-tradition: the warp symbolizing regional traditions, the weft, horizon styles, the two making a decoration of irregular rectangles representing as horizontal bands the various stages of the co-tradition. The side edges are area limits and the bottom and top edges, time limits. True, this is a pretty complex simile for the paleo-Indian as we know him now. But he was endowed with a perfectly tangible culture of some implied complexity, and his works indicate certain traditions. To adapt the concept to his life and times, let us offer the simile of the crudely-sewn garments such as an upper paleolithic citizen of the era could well have devised. The skins of the leggings and blouse or parka represent the broad regional traditions, and the thread binding the fabric together represents the essential and distinctive traits common to the paleo-Indian over the entire continent and throughout several thousands of years. The ensemble of the outfit is the paleo-Indian co-tradition — not devised to fit the advanced Peruvians, but an entity which, under the terms of a modified and adapted definition, may be equally meaningful. If the fabric of the concept is somewhat incomplete and draughty at this stage, it is up to the archaeologists to provide missing skins and thread, as evidence is brought to light.

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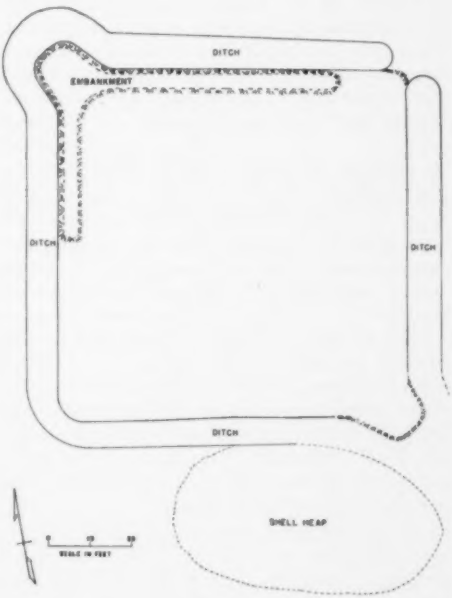
September, 1953.

A NOTE ON FORT MASSAPEAG

Prior to 1950 Fort Massapeag was a well preserved earthwork covered by a dense growth of trees, bushes and trailing vines. In August 1953 I learned that the site had been virtually obliterated by the action of bulldozers making way for the extension of Harbor Green, a real estate development adjacent to the village of Massapequa, Long Island. George Peters of the Department of Public Works, Nassau County, showed me a map on which traces of the earthwork had been plotted before the bulldozers had scraped and furrowed the area, but after the north wall and ditch had been dug away. A visit to the site was unrewarding. A heavy growth of weeds along with a pile of uprooted trees completely masked the area where the fort had stood. At this writing negotiations are in progress for the acquisition of the site by Nassau County in order to preserve what remains. Figure 28 is based on maps made in 1937 and 1938.

Fort Massapeag is a rectanguloid earthwork built between 1640 and 1654 by a tribal group known variously as the Massapeag, Marsapeage, or Massapequa. The site is situated on Fort Neck, a peninsula projecting into South Oyster Bay between Massatayun and Jones creeks, on the southern side of Long Island and within sight of the water tower at Jones Beach State Park. A brief description of the fort appears along with an analysis and classification of the artifacts in my interpretation of the archaeology of Long Island and nearby areas (Smith, 1950).

Of the five or six forts known to have existed on eastern Long Island, Fort Corchaug is the only one Solecki could find to excavate. Most of the others have been destroyed. A few remain to be located. Solecki (1950) has reported on his work at Fort Corchaug in



FORT MASSAPEAG
MASSAPEQUA, LONG ISLAND
NEW YORK

FIG. 28.

detail. I (Smith, 1950) have presented a summary of the data from the same site. Fort Massapeag is the only aboriginal fort known to have existed on western Long Island. All of the forts on Long Island seem to have been more or less contemporary, dating from the middle of the 17th century. In terms of the McKern classification, Fort Corchaug is a manifestation of the Fort Corchaug focus of the Shantok aspect; Fort Massapeag belongs to the Fort Massapeag focus of the East River aspect. Both aspects are assigned to the Northeastern phase of the Woodland pattern.

Solecki mapped Fort Massapeag in May, 1937 (Solecki, unpublished field notes). The existence of his map was unknown to me when I surveyed the site with the assistance of Robert E. Fieux in November, 1938. A compass and 100 foot tape were used in making both maps. When plotted to the same scale they differ only to the extent that the bastions appear slightly larger on Solecki's map. In preparing Figure 28 the maps of 1937 and 1938 were superimposed; the map represents a compromise between the two. The Department of Public Works map indicates that the south and east sides may have been more irregular than shown here.

As may be seen in Figure 28 the enclosure is almost square with projecting bastions at the northwest and southeast corners. Measurements taken from north to south and from east to west are nearly identical, approximately 100 feet. At the time the maps were made the average depth of the ditch as seen on the surface was one foot. A natural rise in ground appears to have been selected as the site for the construction because the enclosed area is approximately six inches higher than the level ground surrounding the fort. The seeming absence of the ditch at the southeast corner may be attributable to encroachment of refuse upon the ditch from the shell heap on the south side. The break in the ditch at the northeast corner probably marks the entrance to the enclosure. Extending east and south from the bastion at the northwest corner is an embankment of earth rarely exceeding eight inches in height above the level surface of the interior of the fort.

Test excavations within the enclosure failed to reveal evidence of human activity. Refuse in the form of marine shells mixed with stained earth, animal bones, débris resulting from the manufacture of wampum, worked stone, potsherds, and objects of European manufacture was concentrated in the form of a low mound outside the enclosure on the south side. The shell heap had been disturbed by the haphazard activities of relic hunters and the sample obtained in our excavations was small. A limited excavation at the southwest corner by George Peters some 20 years ago revealed 4 posts, from 6 to 10 inches in diameter just inside the ditch and following the west wall. From the absence of refuse within the enclosure and its concentration outside I conclude that the fort served as a refuge rather than as a fortification surrounding habitations.

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October, 1953.

PICTOGRAPHS OF THE SAN LUIS REY BASIN, CALIFORNIA *

The San Luis Rey River flows westward across northern San Diego County, California. The area from Henshaw dam down to and including the Bonsall post office can be described as the central San Luis Rey River basin. It includes a little less than half of the total watershed area but contains many tributary streams and probably accounts for more than half of the total runoff. The area is mountainous and wooded or brush covered and is dissected by numerous small streams, many of which originate in the higher elevations of the Agua Tibia and Palomar mountain ranges.

Ample water supplies and favorable thermal zones which belt the area, coupled with a heavy growth of forest cover along the streams, provided both vegetal and animal food supplies which in turn resulted in more than average aboriginal population. The heaviest concentrations of population were in the areas now known as Pauma Valley, Rincon, The Potrero, and the La Jolla area, all of which still have sizable Indian populations living on reservations. In historic times, the region was occupied by Indians of the Luiseño stock (Kroeber, 1925, p. 648).

The pictographs described herein are located within this central basin of the San Luis Rey. A total of 15 pictograph sites was recorded in this area by the writer. Detailed descriptions of the sites are on file at the University of California at Los Angeles. The heaviest concentrations of sites are at Pauma, Rincon, and the Potrero. This concentration of pictographs is due to the large number of Luiseño village sites found in this relatively small area, and partly to more extensive survey efforts in this area.

It appears likely that there is at least one pictograph location for each village site. Of the former the majority conform closely to ethnographic descriptions. Most pictographs are located some distance from the village site on isolated boulders or rock outcrops. The remainder are at the village sites or occupation areas and in small cave shelters. Most sites are found on the rocky

* The author wishes to express his appreciation to C. W. Meighan, University of California at Los Angeles, who read an earlier version of the manuscript and offered many helpful suggestions.

points of small hills extending into the valley. Generally they are less than one hundred feet above the stream level or village level and in some cases are found at stream level, although in some isolated instances they are found higher on the hillsides. There does not seem to be any preferred direction that these paintings must face since they are found facing in almost every direction as regards both the compass and the village sites. However, there were undoubtedly requirements for locating the paintings other than that they should be conspicuous and on suitable rock surfaces. To date no information on this problem has appeared, and there are many suitable locations and rock faces which fulfil all known requirements but lack the paintings. Granitic bedrock intrusions make up the greater part of the exposed boulders and rocky ridges, with the dense weather resistant stones standing exposed on hills and slopes of decomposed granite, or on residual clay soils of granitic origin. The majority of the paintings are found on these dense exposures with a few being found on a metamorphic rock found in pegmatite dike exposures. The paintings found on the rather coarse-surfaced stone are usually found in cave shelters or on overhangs, while the exposed paintings are nearly always on granite boulders.

Most of the boulders are streaked with a travertine-like deposit or a reddish stain, and the best of the painted areas are found on the deposits or stains. Design elements on any given rock will usually range from clearly discernible elements on the stained areas to faint illegible blurs on the bare rock surfaces. It is likely that the presence of the mineral deposit provided a base into which the pigments could penetrate, thereby preserving the paintings.

The association between pictograph sites and known Luiseño village sites is clearly visible by the manner in which these sites fit the ethnological descriptions. The relatively nonpermanent nature of the medium is such as to eliminate, in almost every case, any ideas regarding pre-Luiseño painting of the pictographs. There is no evidence to date to indicate pictograph painting by any prepottery Luiseño occupants of this area. The association of these pictographic representations with certain distinctive ceremonials gives us one of the few cases in which explanations of petroglyph origins exist. Indians in other petroglyph areas usually deny knowledge of the designs and in many instances appear to be afraid of them. Here then we evidently have a documented association between petroglyphs and their makers.

The earlier ethnological accounts disagree on many of the details surrounding the ceremonies with which these rock paintings are associated, but they all agree on the general custom with which the majority of the known sites conform. This is the use of pictograph paintings as part of ceremonies that are concluded by a race, in which the participant, or a relative, ends by painting a design on a previously designated rock.

Kroeber's earlier account reports:

> The conclusion of the girls' period of restrictions at puberty was marked by paintings made by them on the smooth surfaces of large granite boulders. These paintings, some of which can still be seen, especially near the old village sites, consist of geometrical arrangements of lines in red, usually in patterns forming vertical stripes several feet high. After making her painting, a girl was again free to eat meat and salt. The paintings were called *yunnish* (Kroeber, 1908, pp. 175-76).

A variation within the ceremonies is noted in Kroeber's later account, but he again mentions the geometric designs and the race.

> The girls accompanied by friends, thereupon run a race, another ceremonial device of which the Luiseño are fond. The chief's wife again paints them. With the same paint she makes a large geometrical pattern upon a rock, or according to another account, the girls themselves do so. This face and rock painting is performed monthly three or four times (Kroeber, 1925, p. 675).

Strong again cites a variation in the ceremonial pattern, but describes the same general customs as the others, and also describes the design elements in a similar way.

> The sand painting ceremony closed with a race, called hayic (or hayish) to a certain rock. Here a relative of each girl stood with red paint, and as each girl arrived she painted a design on the rock. According to Yela Wassuk any design was permissible, but other informants said such designs were always diamond shaped and represented the rattlesnake. The known rock paintings of this type at Rincon and La Jolla are geometric with a preponderance of diamond shaped designs (Strong, 1929, p. 299).

Sparkman's account does not mention details of the race or rock paintings but does link the paintings of pictographs to the girls' puberty ceremonies. The majority of the paintings were probably made in connection with these rites, but pictograph painting is also described in connection with the boys' ant ordeal ceremony which is part of their Toloache initiation. A pattern similar to the girls' puberty race appears to apply in this case also and is referred to by both Du Bois and Strong.

> A race was then held by the candidates, probably similar to the races made at the time of the new moon; and the winner of the race painted in the designated place with red and black paint (Du Bois, 1908, p. 92; cf. Strong, 1925, p. 317).

In addition to the ant ordeal, the Toloache ceremony itself may have included pictograph painting, but the only ethnographic reference to this is a conjecture made by Du Bois (1908 p. 84). Inasmuch as the Cupeño and Serramo Toloache ceremonies were closed by such a race it is not at all difficult to imagine that the Luiseño also, at one time or another, included the race and pictographs in their Toloache ceremonies. Strong cites Du Bois' opinion and, although lacking direct evidence, admits the possibility of such a race by the Luiseño (Strong, 1929, p. 316). Descriptions of both the girls' puberty rites and the boys' ant ordeal ceremonies easily correspond to observable patterns of pictograph sites found in the San Luis Rey basin.

There is little doubt that the Luiseño confined their petroglyph activity to the painting of pictographs as no authentic pecked designs or elements have been found in their territory.

In the painted pictographs found, the colors are limited to red and black with red being the dominant color. Du Bois indicates that red, black, and white

colors were used (Du Bois, 1908, p. 96), but no white painting has been found on any site yet. Kroeber cites the use of red paint (Kroeber, 1908, p. 175-6), while Strong mentions the use of red in connection with the girls' puberty rites, and the use of red and black in the boys' ant ordeal ceremony (Strong, 1929, pp. 229, 317).

The reds vary in shade from rather deep brick reds to somewhat faded orange tints. These variations in color must be considered in terms of paint formula variations, the rock surfaces on which the paint is placed, the degree of weathering, and the relative age of the painting. Of the paint itself, little is known except from ethnological accounts. Sparkman describes it as being made of a certain pigment obtained from springs on Mount Palomar, mixed with turpentine (made from pines on Palomar) and with an oil base made of an extract from the seeds of the Chilicothe (*Echinocystis Macrocarpa*). It is probable that the seeds were ground and the oil extracted at the site of the paintings since nearly every site has many of the vines growing around the base of the painted rock. The presence of this plant is not conclusive evidence, for this is a common plant in the region. However, its presence on nearly every site checked so far does tend to strengthen the ethnological descriptions of the paint ingredients. The seeds and paint pigments are described as being ground in a small mortar made especially for this purpose. This mortar, *Tamya-mal*, is described as being polished and almost exactly round (Sparkman, 1908, p. 207). To date not one of these has been found on or near any of the pictograph sites. They do exist however, and were more than likely buried with other ceremonial devices by the person in charge of the rites. A modern Luiseño informant indicates that such ritual objects were hidden or buried by chiefs or medicine men. On many of the sites small bedrock mortars are found which were probably used in a manner similar to the *Tamya-mal*. This type of bedrock mortar is also found in association with painted petroglyphs farther north on the western slopes of the Sierra (Mallery, 1889, p. 54).

All ethnological sources agree that animal fats were not used in the paints, and these earlier accounts regarding paint constituents are further substantiated by a chemical analysis of pigment taken from painted rocks. This showed that the pigment for red was ferric oxide and for black, manganese oxide (Harrington, 1933, p. 142).

When used in red paint the chilicothe kernels were toasted, but not charred, prior to being ground. For black pigment they were charred and roasted on a piece of burning oak bark, after which they were pounded up fine and mixed with the ground manganese oxide (Harrington, 1933, p. 142).

The iron oxide is obtained from hydrated hematite which is found in local rocks and the scum from certain springs. This scum consists of depositions by bacteria; in the summer it is gathered by the Indians, dried in the sun, and then burnt on a slab of oak bark (*Quercus Kellogii* or other local oak species). For detailed descriptions of these bacteria and the processes involved in their use as paint pigments see Harrington, 1933, pp. 141-44. Other materials were used for paints ethnographically, but these were not of the permanent nature of the pigments just described and they are not found on any of the sites. Such materials as soot, charcoal, clay, and ashes could not be expected to survive for any length of time on exposed rock faces.

Steward has defined southwestern California as a distinctive petroglyph area (his area C). He describes the characteristic elements as follows:

> They stand apart from zig zags found elsewhere, not only in being painted and assembled in a characteristic manner but because they are connected with the girls' puberty ceremonies. In this region zig zags are combined in many ways. Generally there are several groups. These are made up of a number of parallel zig zags placed close together, or of zig zags superimposed in such a way as to form chains of diamonds. The color is almost invariably red. Their distribution falls entirely in southern California. . . . Few other designs occur in this area (Steward, 1929, p. 203).

Fenenga's later report describes the design elements somewhat further and characterizes them as being dominated by red painted petroglyphs of geometrical forms in linear arrangement, especially chains of diamonds and parallel rows of zigzag lines. These are found on the vertical faces of isolated boulders (Fenenga, 1949, p. 2 and fig. 1).

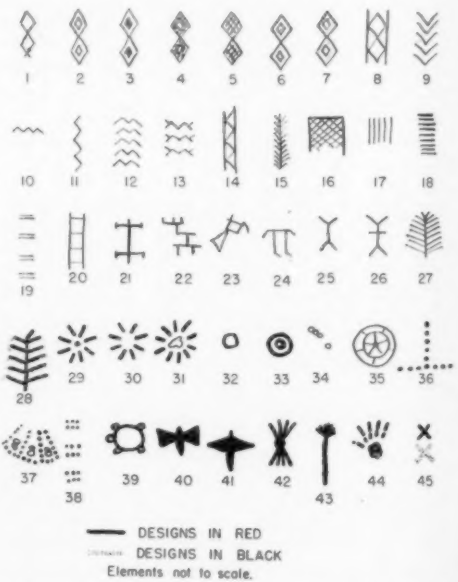

FIG. 29. Pictograph design elements, San Luis Rey basin, California.

Simple geometric forms greatly predominate in the pictographs. Quadruped animal representations are absent and anthropomorphic figures are exceedingly rare, even including highly stylized figures which are rather dubious man-like representations. Spirals and snake forms, common in many other areas are not found.

It is possible that some of the elements found in Luiseño rock paintings represent the Chingichnich cult animal forms. The manner in which these paintings are directly associated with religious rites and the fact that many of the rites involved the use, in one form or another, of the cult animal forms leads to this conjecture. One of the most commonly used forms in Chingichnich rites is the rattlesnake. The possibility that the diamond chain pattern represents the rattlesnake is suggested in Strong's account (Strong, 1929, p. 299). The diamond chain is the most common of all the elements used in Luiseño pictographs.

In this survey of fifteen sites which form a representative sample of all the known pictograph sites in the area, we find that there is considerable variation as regards the assembly of the typical chevrons, diamonds, and zigzags and also regarding the types of units in a given design. The recognizable variations total about thirty separate design elements. This does not take into consideration minor variations nor does it include the many blobs and blurs which occur on almost every site. Of these elements eight are identical to those illustrated by Fenenga. (Fenenga, 1949, Fig. 2, design elements 8, 13, 14, 21, 23, 25, 26, 33.) There are three others that are similar but not identical to numbers 12, 22, 37 of Fenenga's Fig. 2. This leaves over twenty elements or variations which have not been previously reported and which represent less common petroglyph designs in Southern California.

FIG. 30. Distribution of pictograph sites, San Luis Rey basin, California.

The elements found in this region can be separated into two general classes: those which are geometrical patterns and those which appear to represent natural forms. The geometrical forms make up the bulk of the paintings and can be divided into various units, the most obvious of which are the diamonds which make up the chains, the chevrons which make up the zigzag lines, simple crosses, X's and straight lines assembled in various ways. The most common is the simple single line diamond unit (Fig. 29, *1*). Variations of this element are shown in Figure 29, *2-7*. The manner in which these diamond units are assembled is variable as to the size and number of units which are put together, but they are always assembled vertically to form chain designs (except when found as single motifs). Occasionally they are found inclosed in vertical lines.

Chevrons which are combined to form the various zigzag line elements are found in several patterns (see Fig. 29, *9-15*). The use of lines to create crosshatching, single vertical lines, single horizontal lines, and groups of both vertical and horizontal lines in some manner of assembly is common (Fig. 29, *16-19*). Ladder forms are found, but are not common (Fig. 29, *20*). Other single line forms are found occasionally (Fig. 29, *21-23*). The double Y and a modification are found only occasionally (Fig. 29, *25, 26*). The single lined circle and concentric circles or target forms are not common but have been recorded from several sites (Fig. 29, *32, 34*). A more complex form of the circle or target element is found in the wheel form which is found only at site S.D. 151 (Fig. 29, *35*). The use of small dots in vertical or horizontal rows is found on only one site so far (site S. D. 151), but at this site it is the dominating element (Fig. 29, *36*). A variation of this design is the cage-like enclosures containing elements which appear to be figure eights (Fig. 29, *37*). Further use of small dots is made in elements in which the dots are assembled in groups of six, into squares about one and one half inches across, and which are grouped in lines about three fourths of an inch a part. These groups are made into chains, usually straight but sometimes having a curve on one end.

Although elements that resemble natural forms are rare, a few such elements have been found. These are summarized as follows:

1. Tree-like figures, one of which has the tips of the "branches" tipped in black (Fig. 29, *27, 28*).

2. "Sun figures" or elements with lines radiating from a central spot. These are widely distributed and are found with several variations (Fig. 29, *29-31*).

3. A turtle-like figure at site S.D. 152 (Fig. 29, *39*).

4. Bird and insect-like forms at Potrero Indian reservation (Fig. 1, 40-42).

5. A figure which appears to be a palm tree at one La Jolla site (Fig. 29, 43).

6. Hand prints, which appear on several sites (Fig. 29, 44).

7. A possible schematic representation of a human at site S. D. 153. The visible portion extends from a rather confused mass of blurred elements. This problematical figure represents the only anthropomorphic element from the region.

Such elements as diamonds, chevrons, dots, and simple line forms can be traced in petroglyphs throughout California and the southwest. It is only in the characteristic manner of assembly and the circumstances under which they were made that the pictographs of this area become especially distinctive. The distinctive use of the geometric forms and the almost complete absence of many elements common to other petroglyph areas cause the designs of this region to stand out in a comparative study.

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Pauma Valley, California
August, 1953

PUBLICATIONS ON AMERICAN INDIAN PHYSICAL ANTHROPOLOGY
1952 — 1953

In a previous communication (*American Antiquity* 19-3, January 1953, pp. 290-91), I noted significant items in this field during the period 1948-1951, with probably incomplete coverage for the first half of 1952. Additions to that bibliography and this one will be appreciated by the present writer and by the management.

First of all, in supplementation for 1952, must be mentioned the valuable compilation, with year-by-year general trend statements (taken from the *Handbook of Latin American Studies*) and a subject index: T. D. Stewart, *A Bibliography of Physical Anthropology in Latin America: 1937-1948*, published by the Wenner-Gren Foundation, New York, 1952.

The seventh *Yearbook of Physical Anthropology, 1951* (edited by G. W. Lasker and W. L. Straus, Jr., published by the Wenner-Gren Foundation for Anthropological Research, Inc., 14 E. 71st Street, New York, 1953) cites papers of that year omitted in my abovementioned list, including the following: R. E. Popham and W. D. Ball, "Eskimo crania from Southampton Island," *Revue Canadienne de Biologie*, 10: 435-42; Marshall T. Newman, "Skeletal material," in J. L. Cotter and J. M. Corbett, *Archeology of the Bynum Mounds, Mississippi*, National Park Service Archeological Research Series No. 1, Washington (G.P.O.), 1951; T. D. Stewart, "Antiquity of man in America demonstrated by the flourine test," Science 113:391-92 (concerning the Natchez pelvis); E. Dávalos Hurtado, "La deformación craneana entre los Tlatelolcas" (Escuela Nacional, Mexico, 99 pp.); five papers on dental details and mutilation or loss of teeth; one on blood pressure, a few on constitution and growth, and several on blood-groups.

Two general papers of major importance on Arctic prehistory, including questions of racial type, are reprinted in this yearbook: Henry B. Collins' "Origin and antiquity of the Eskimo" (from the *Smithsonian Institution Annual Report for 1950*) and W. S. Laughlin and G. H. Marsh, "A new view of the history of the Aleutians" (from *Arctic* 4-2). Reprinted also, and of quite general interest, is a paper on "Stature, body-build, and tooth emergence in Aleutian Aleut children," by Stanley M. Garn and Coenraad F. A. Moorrees (from *Child Development* 22-4).

In the September 1952 issue of the *American Journal of Physical Anthropology* (Volume 10, No. 3), there are three papers on New World subjects: R. F. Heizer and S. F. Cook, "Fluorine and other chemical tests of some North American human and fossil bones"; W. A. Ritchie, "Paleopathological evidence suggesting pre-Columbian tuberculosis in New York state"; C. F. A. Moorrees and others, "Torus mandibularis, its occurrence in Aleut children and its genetic determinants." In the December 1952 issue of AJPA (Volume 10, No.

4) there are two: A. M. Pantin and P. C. Junqueira, "Blood groups of Brazilian Indians" and Kaare Rodahl, "The body surface area of Eskimos" (methodology rather than general findings), and also a quotation from a paper by J. J. Graydon, "Blood groups and the Polynesians," *Mankind* 4-8, March 1952, which points out the relationship to America indicated by the Polynesian data (cf. M. Shapiro, "Blood groups and skin colour," *Journal of Forensic Medicine* 1-1, July-September 1953, p. 4).

At the 21st meeting of the AAPA (in New York, March 1952), no papers on American Indian subjects were given. At the 22nd meeting (in Philadelphia in December 1952, jointly with the American Anthropological Association), there was one highly important general paper on "Adaptive change and race formation in the aboriginal New World," by Marshall T. Newman, published in expanded form in the *American Anthropologist* in 1953 as cited below.

Among other papers appearing during 1952, that of perhaps the greatest interest to archaeologists is Georg K. Neumann, "Archeology and race in the American Indian," in the Cole Volume (*Archeology of Eastern United States*, ed. James B. Griffin, Chicago, 1952), a general review of racial types in North America with a new set of variety names; see the discussion by J. Lawrence Angel in the review of this volume in *American Antiquity* (Volume XIX, No. 2, October 1953, pp. 172-73). The June 1952 issue (Volume 12, No. 5) of the mimeographed but permanently valuable *Museum News* of the W. H. Over Museum, University of South Dakota, summarizes the interesting and significant results of Dr. Neumann's analysis of the Plains Indian skeletal collection at that institution, including Mandan, Yankton Sioux, Arikara, Ponca-Omaha, and Woodland (burial-mound) skulls. There is a paper on cranial injuries among early Indians of California, by Cyril B. Courville, M.D., in the December 1952 issue of the *Bulletin of the Los Angeles Neurological Society*.

Several of the papers from the XXIXth International Congress of Americanists (held in New York in September 1949) published in the volume *Indian Tribes of Aboriginal America* (edited by Sol Tax; University of Chicago Press, 1952) are on topics of physical anthropology dealing with Mexico and South America: J. Comas, "Cálculo de la talla de Mexicanos del Valle de México a base de la longitud del femur" [pre-Spanish shorter than modern]: Antonio Santiana, "La mancha mongólica en los aborígines del Ecuador"; T. D. McCown, "Ancient man in South America"; Martin Gusinde, "El tipo antropológico del índio sudamericano"; and a few concerned entirely with modern populations. Eskimo somatology is briefly discussed in Kaj Birket-Smith's survey, "Present status of the Eskimo problem," in the same volume, and there is also a summary by P. O. Pedersen of the findings of his "Anatomical studies of the East Greenland Eskimo dentition."

Several reports on skeletal material from archaeological excavations have appeared in 1952 and 1953, particularly from the Southwest: George Ennis, "Human skeletal remains from Big Hawk Valley" (in Watson Smith, *Excavations in Big Hawk Valley, Wupatki National Monument, Arizona*, Museum of Northern Arizona Bulletin 24, Flagstaff, Arizona, 1952); R. E. and M. V. Gerald, "Human skeletal material from Quiburi" (in C. C. Di Peso, *The Sobaipuri Indians of the upper San Pedro River Valley, southeastern Arizona*, Amerind Foundation No. 6, Dragoon, Arizona, 1953); E. K. Reed, "Human skeletal material from Te-ewi" (in *Salvage Archaeology in the Chama Valley, New Mexico*, assembled by Fred Wendorf, School of American Research Monograph No. 17, Santa Fe, New Mexico, 1953). Similar studies from other areas include: Marshall T. Newman, "II. Indian skeletal remains from the Doering and Kobs sites, Addicks Reservoir, Texas," pp. 253-66, in Paper No. 4, "The Addicks Dam Site" (pp. 143-266), in *River Basin Surveys Papers Nos. 1-6*, Bureau of American Ethnology Bulletin 154, Washington, D. C., 1953; and undoubtedly others.

The short paper by R. F. Heizer and S. F. Cook on "Capay man, an ancient central California Indian burial," in UCAS-22 is concerned with dating only and does not describe the skeleton. In an ethnological monograph is found Marshall T. Newman, "Appendix 3. Anthropometry of . . . Northern Mato Grosso tribes," pp. 128-35, in: Kalervo Aberg, *Indian Tribes of Northern Mato Grosso, Brazil*, Institute of Social Anthropology (Smithsonian Institution) Publication No. 15, Washington, 1953.

The only paper on a New World subject in the March 1953 issue (Volume 11, No. 1) of the AJPA is a six-page report on "The blood groups of the Diegueno Indians," by A. M. Pantin and Robert Kallsen. Of greater interest for American archaeologists is "A collaborative genetical survey in Ainu: Hidaka, island of Hokkaido," by R. T. Simmons, J. J. Graydon, N. M. Semple, and S. Kodama, which tends to distinguish the Ainu rather definitely, both from the Australians and particularly from the American Indians, and to indicate that genetic evidence militates against the hypothesis of a "proto-Caucasian" element common to all three peoples. In the June issue (AJPA 11-2), there is another paper on Eskimo fingerprints; in September (AJPA 11-3), one on blood-groups of the Blackfoot Indians; in December (AJPA 11-4), nothing on American Indian anthropology.

A recent article of the very greatest importance is: Marshall T. Newman, "The application of ecological rules to the racial anthropology of the aboriginal New World," *American Anthropologist* 55:311-27 (No. 3, August). Instead of establishing another set of more or less arbitrary types, Newman points out that the ranges in body, head, and face sizes and proportions among American Indians appear to be adaptive responses to environment following roughly the well-known biological principles of less exposed skin sur-

face relative to body mass in cold climates, and vice versa, among other mammals generally; and can have developed since the original entry from Asia, say 15,000 years ago, of a single original group (cf. J. L. Giddings, "Ancient Bering Strait and population spread," in *Selected Papers of the Alaskan Science Conference* [of November 1950], Arctic Institute, Washington, 1952).

Papers presented at the 1953 meeting of the American Anthropological Association (at the University of Arizona, Tucson, December 28-30) included one on physical anthropology in the Southwest, by James N. Spuhler. The AAPA held no regular meeting during 1953.

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January 1954

THE POSITION OF IPIUTAK IN ESKIMO CULTURE

The reason for the following is an article by Henry B. Collins: "Radiocarbon Dating in the Arctic" which appeared in the January, 1953 issue of American Antiquity. This is the third article in four years in which Collins comments on the interpretation of the Ipiutak culture advanced by Froelich Rainey and me in our publications on the excavations at Point Hope, Alaska, 1939-41 (Larsen and Rainey, 1948). Although critical regarding certain points in our theory on the development of Eskimo culture, his comments in the first two articles are on the whole objective and justifiable (Collins 1950a and 1951). His latest article, however, is written in a surprisingly sharp, polemic form which is entirely unprovoked and it contains statements which disclose that he has misunderstood certain important points in the Ipiutak report and misinterprets archaeological evidence. My aim is not to begin a polemic because experience shows that polemics are merely a waste of valuable time and print; they often foster ill feelings and seldom give positive results. However, for two reasons I feel that Collins' articles should not remain unanswered. First I feel that the readers who are not familiar with Eskimo archaeology must be rather uncertain regarding the present status of this discipline and are entitled to a clarification. Second it is my hope that these lines may result in an adjustment of the divergencies in our conception of the development of Eskimo culture so that in the future we may pull in the same direction. Students in this particular field are so few and the problems have become so intricate that we need the combined efforts of all to get to the bottom of them. Of course I do not expect or even want Collins to accept our viewpoints outright, but in case of disagreement I do expect sound scientific documentation and not mere statements.

In his article of 1951 we find, in a concentrated and urbane form, Collins' viewpoints regarding the Ipiutak report: "It is possible to accept the Asiatic affiliations of the Ipiutak culture, its relationship with modern Bering Sea and prehistoric South Alaskan and Dorset cultures, and its possible, but not yet proved, association with inland Eskimo culture as represented by the Nunatagmiut.* At the same time one may question the reality of the proposed dichotomy in Eskimo culture, the dissociation of Ipiutak and Old Bering Sea, the view that Ipiutak is a transplanted Asiatic culture, and the assumption that Ipiutak, strongly influenced as it was by late bronze- and iron-age cultures of Eurasia, was older than and ancestral to all other known forms of Eskimo culture." With the dichotomy of Eskimo culture Collins refers to our demonstration of two layers of Eskimo culture at Point Hope, a paleo-Eskimo and a neo-Eskimo, and the distribution of these two layers. Actually we have not proposed a dichotomy but in our interpretation of the development of Eskimo culture we followed Steensby (1916) and Kaj Birket-Smith (1929) in their viewpoints regarding a stratification in Eskimo culture. Birket-Smith, whose theory is the more comprehensive, distinguishes between four culture layers of which the earliest, proto-Eskimo culture, gave rise to a paleo-Eskimo and this in turn to a neo-Eskimo and an eschato-Eskimo culture, each of them representing an essentially different form of Eskimo culture. The cause of the development of a new culture may be a change in environment, contact with other peoples, or both. Though not all cultures had the same power of expansion there is hardly any part of the Eskimo area which has not been exposed to at least two cultural waves of which we may find archaeological or ethnographical evidence. A good example is the eastern Canadian Arctic which during the last thousand or more years has been the home of at least three distinct forms of Eskimo culture, the Dorset, the Thule, and the culture of the present-day central Eskimo. Since all agree that they occupied the region in that order we may as well use Birket-Smith's terminology and speak about an occupation by paleo-, neo-, and eschato-Eskimo, the latter meaning the latest. At the time of Birket-Smith's publication there was no archaeological evidence of the paleo-Eskimo culture (the Dorset culture was barely known) and it was not until the discovery of the Ipiutak culture that the idea of a stratification in Eskimo culture was taken up again[1].** At Point Hope we found, as I shall show presently, two different forms of Eskimo culture of which one was definitely more old-fashioned than the other, and because the latter was identical with Steensby's and Birket-Smith's neo-Eskimo culture it was not a far step to identify the former with their paleo-Eskimo culture. Contrary to Birket-Smith we considered at that time the Asiatic mainland to be the home of the proto-Eskimo while in the main we accepted his view on the origin of the culture of the central Eskimo.

* In accordance with the pronunciation of the name we spelled it Nunatarmiut, the same spelling as used for instance by Knud Rasmussen (Ostermann 1952, p. 142).

** The bold face numerals in brackets key into Collins' reply which follows.

Collins' next question, the dissociation of Ipiutak and Old Bering Sea, is intimately connected with the question of stratification[2]. When we began our investigations at Point Hope, Collins' work on the archaeology of St. Lawrence Island was the latest comprehensive publication dealing with Eskimo archaeology as a whole. In the summary of this work Collins expresses his view on the known prehistoric cultures in the following way: "We have seen that on St. Lawrence the Old Bering Sea culture gave rise to the Punuk; that on the arctic coast it was apparently ancestral to the Birnirk, the stage from which the Thule, the dominant prehistoric culture of the central regions, was derived. The Dorset and Cook Inlet cultures differ in so many respects from the Old Bering Sea that we can say little as to what relationship may have existed between them and the latter. Neither of them, however, are Eskimo cultures in the same sense as is the Old Bering Sea culture, which in spite of its specialized development in certain directions is fundamentally Eskimo, and basic, apparently, to the existing phases of northern Eskimo culture from Siberia to Greenland (1937, p. 379). We were thus in agreement with Collins when we considered Old Bering Sea and the other stages of northern Eskimo culture part of the same complex which we may call the Arctic coast pattern (Rainey 1941), the Arctic Whale Hunting culture or the neo-Eskimo culture. The bearers were "a maritime people who lived in permanent villages on the seacoasts and who depended for their livelihood on seals, walrus, fish, and birds" (Collins 1951, p. 429). Though whaling harpoon heads and baleen implements occur in all stages, it is of course possible, as Collins postulates, that whaling in the earlier stages was practiced only to a limited extent; later, however, it became a very important economical factor.

At Point Hope we found four stages of this culture but in addition we found the Ipiutak culture which we for the following reasons dissociate from the neo-Eskimo culture. The Ipiutak people were seal and walrus hunters but their weapons and the extensive use of antler as material for tools show that caribou hunting was of at least equal importance with sea mammal hunting. This in connection with other inland features like the use of birch bark for vessels, willows as platform covering, dependence of wood for fuel, and the absence of blubber lamps and gear for open-water hunting indicate that they were not a maritime people in the same sense that the neo-Eskimo were. There are strong indications, though not conclusive evidence, for our assumption that Ipiutak was not a permanent village but a summer camp for caribou hunters who must have spent the rest of the year inland. The inland traits and the fact that the Nunatarmiut of arctic Alaska used the Ipiutak type of house up to the present day led us to the conclusion that the Ipiutak people like these were seasonal migrants with an economy based upon sea mammal and caribou hunting, in other words a coast-inland culture. The most conspicuous feature of the Ipiutak culture is the extensive use of chipped stone tools; close to 5000 specimens or 52 per cent of the total find are finely chipped blades, scrapers, and gravers of flint, chert, and other hard materials. Slate was not used by the Ipiutak people but was to a great extent by the later neo-Eskimo of Point Hope. In comparison Collins found at his earliest site on St. Lawrence Island, the Hillside site, 382 stone implements of which 101 were of chert or jasper, and 281 of slate. Of the latter 141 were chipped and 140 rubbed (Collins 1937, p. 147). Slate was also predominant in the pure Okvik sites described by Rainey (1941). Of equal importance is the fact that in the Okvik and Old Bering Sea phases [3] we find a number of significant culture elements which are absent in Ipiutak, viz., float plugs, float bars, float mouthpieces and stoppers, finger rest, wound plugs, meat or boat hooks, fishhooks, fishline sinkers, pottery, lamps, the typical Eskimo ulo, bow drill, carved needle cases, combs, drum handles, ice creepers, ivory sled runners, and implements made of baleen. When we add the fact that the Ipiutak house was of an entirely different type of construction, I believe we are justified in dissociating Ipiutak from Okvik and Old Bering Sea. The cultural elements mentioned above are far more important than a certain resemblance in art, in fact it is some of these elements, in particular the gear for open-water hunting including whaling in its arctic form, which gave the neo-Eskimo culture the impetus toward the enormous expansion which carried it from the western to the eastern limit of the Eskimo territory. It cannot be an accident that these elements do not occur among the Ipiutak finds because these are much more numerous than the finds of Okvik and Old Bering Sea; the only feasible explanation is that the elements in question are new acquisitions in Eskimo culture and that Ipiutak in this as in other respects represents another and older culture complex[4]. That Ipiutak actually was part of a complex with a wide distribution rather than an isolated phenomenon became evident when we compared it with the cultures Collins had dissociated from the northern Eskimo culture, the Dorset, Cook Inlet, and Aleutian cultures.

Collins dissociates Dorset from Old Bering Sea because "the latter is already in many respects a highly developed Eskimo culture, possessing important features of which the Dorset culture had no knowledge" (1937, p. 373). With the exception of lamps and possibly ice creepers the list of Old Bering Sea features absent in Ipiutak is also applicable to Dorset. When we add to this the fact that Dorset apparently was a coast-inland culture with an economy based upon the same game animals as Ipiutak, without knowledge of open-water hunting with float, and with the same preponderance of chipped stone implements, we felt that we had sufficient evidence for considering Dorset an "eastern parallel to the Ipiutak culture" and belonging to the same complex. Because Ipiutak was the better known of the two we called it the Ipiutak complex or the paleo-Eskimo culture. The predominance of chipped

stone implements is also characteristic of Kachemak Bay I and early Aleutian cultures and because both cultures have other elements in common with Ipiutak and Dorset we considered them paleo-Eskimo too. This assumption was confirmed or at least strengthened in 1948 when James L. Giddings, Jr., and I, as predicted in the Ipiutak report (p. 183), found paleo-Eskimo culture in the Bering Sea area, thus bridging the gap between Ipiutak and the Cook Inlet-Aleutian cultures. Most significant are Giddings' finds in the stratified Iyatayet site at Cape Denbigh because he found three different forms of culture there, one superimposed on the other. The Denbigh Flint complex at the bottom is the earliest known form of culture in the Eskimo area and may, because of certain similarities with Ipiutak and Dorset, possibly represent the proto-Eskimo layer we expected to find in Siberia and Birket-Smith in Canada. The next layer is the paleo-Eskimo with chipped stone implements similar to those from Ipiutak and Near Ipiutak (another paleo-Eskimo phase at Point Hope), and above it a midden containing organic material, ordinary Eskimo pottery, and rubbed slate implements. A new element was added to the paleo-Eskimo culture-thin, hard, sand-tempered pottery with striated or check-stamped decoration, different from the thick, coarse, and crumbly ordinary Eskimo pottery (Giddings 1949 and 1951). Potsherds of the former type occur also in the Near Ipiutak phase; the presence of stone lamps is another point of connection between Near Ipiutak and the Iyatayet middle layer, which by the way may represent more than one phase. In the Kuskokwim area I found that the earliest house ruins contained a preponderance of chipped stone implements, while these in the later ruins were replaced by rubbed stone tools. Also in this area did we find more than one phase of paleo-Eskimo culture. In the Platinum phase stone lamps occurred but not pottery, while in the Chagvan-Nanvak Bay phase there was pottery of the paleo-Eskimo type. That no lamps were found in the latter is probably accidental. The abundance of flat, notched stone sinkers in the Chagvan-Nanvak Bay phase links this with the Cook Inlet-Aleutian cultures; labrets form another link and they occur also in the Ipiutak culture (Larsen 1950). From the above it seems evident that a culture complex, the most conspicuous feature of which is chipped stone tools, can be traced almost everywhere in the Eskimo area from the Pacific to Greenland. We called it the Ipiutak complex or the paleo-Eskimo culture, but because Ipiutak represents only one phase of this culture I suggest, to avoid confusion, that we in future use the term paleo-Eskimo exclusively. Actually it would be even better to speak about a paleo-Eskimo *complex* in contrast to the Ipiutak *culture*, the Kachemak Bay *culture*, and so on. That would leave us the term "phase" for slightly aberrant forms of a culture, and groups of finds that cannot be incorporated in one of the cultures but on the other hand are too insufficiently known to be described as a distinct culture. Ipiutak and Kachemak Bay are well defined cultures but we have as yet too little material to speak about a Platinum culture; the Platinum phase would be more appropriate. We have the same situation in the eastern Arctic. Of the Dorset culture originally described by Jenness there are now so many variants that it will be very difficult to determine what is pure Dorset. The difference in the types of harpoon heads and stone implements alone shows that here we must distinguish between different phases of Dorset culture. In Greenland, for instance, we are now dealing with four manifestations of the paleo-Eskimo complex. In Disko Bay we found this summer the Sarqaq-phase described by Meldgaard (1952) and closely related to early Alaskan cultures and a later form resembling certain Canadian Dorset finds. Neither of these, however, is identical with the Dorset-like culture from Peary Land (Knuth 1952) or the Dorset finds from Inglefield Land (Holtved 1944). On the other hand they are all paleo-Eskimo and easily distinguishable from the later immigrating neo-Eskimo. When we adopted Steensby's and Birket-Smith's terminology it was because we felt that it was necessary to distinguish between major and minor culture changes if we wanted to keep a clear picture of the development of Eskimo culture.

Two of Collins' questions remain to be answered. Regarding the view that Ipiutak is a transplanted Asiatic culture I may say that at the time it seemed to be the only solution [5]. In America there was no prehistoric culture known which could be ancestral to the Ipiutak culture while there were in Siberia several significant parallels. Collins was the first to point out the similarity between the Ipiutak flint industry and that of the Siberian Neolithic (1943, p. 225). In addition there were the house type, the connection between Ipiutak art and the Scytho-Siberian animal style, and certain parallels with Siberian ceremonialism. But meanwhile the discovery of the Denbigh Flint complex in 1948 and the excavation of the first cave at Trail Creek in 1949 opened new perspectives and at the Americanist Congress the same year I faced the consequences of the new discoveries and discussed the possibility that the Ipiutak culture could have originated in Alaska in which case the Asiatic parallels must be the result of intimate culture contacts across Bering Strait. In the same paper I mentioned the Denbigh Flint complex as a possible proto-Eskimo culture "which gave rise to other forms of Eskimo culture, as for instance the Dorset culture" (Larsen 1952, p. 28).

Collins' last question implies that he has not read the Ipiutak report with sufficient thoroughness because we have in no place expressed the opinion that the Ipiutak culture in the form in which it was found at Point Hope "was older than and ancestral to all other known forms of Eskimo culture." He must mean the Ipiutak in its Point Hope form because it is the only one of the paleo-Eskimo cultures which is "strongly influenced by late bronze- and iron-age cultures of Eurasia" [6]. The Ipiutak culture is part of a complex

and we said explicitly about another member of the same complex, the Dorset culture, that it is "an eastern parallel to the Ipiutak culture." On account of the Thule types in most Dorset finds we considered Ipiutak older than Dorset, and so did Collins for that matter (Collins 1943, p. 225-6). Today I am not so sure; the question is whether burins and the core and blade industry make Dorset older than Ipiutak which on its side has more elements in common with the Denbigh Flint complex and another mesolithic feature, the extensive use of side blades, and I doubt this question can be answered today. We did not express any opinion on the relative age of the Cook Inlet-Aleutian cultures and Ipiutak culture. We do, however, believe that the Ipiutak or paleo-Eskimo complex is ancestral to and older than the neo-Eskimo complex, the Central Eskimo with the exception of the Caribou Eskimo, and the Bering Sea Eskimo [7]. On account of their mode of life and economy we consider the Caribou Eskimo, and Eskimo of northern Alaska, outside the typical neo-Eskimo settlements on St. Lawrence and the Diomede Islands, at Wales, Point Hope, and Barrow, as surviving paleo-Eskimo, though the Alaskan Eskimo have been exposed to strong neo-Eskimo influence, which is reflected on their material culture.

From Collins' latest article, the one which made me write these comments, it appears that he now believes "that old Bering Sea was earlier than Ipiutak and not an outgrowth of it, as postulated by Larsen and Rainey" (Collins 1953, p. 198). Something must have happened which made him change his view on the age of Ipiutak [8] because in 1943, when he first commented on the Ipiutak culture, he wrote that "it is the earliest Eskimo stage, the Ipiutak, that shows the closest resemblances, with side-bladed lance heads and arrowheads directly comparable with those of the European Mesolithic and Siberian Neolithic. These do not occur in later stages of Eskimo culture, though side blades on harpoon heads, which were also present in the Ipiutak, continued in the Old Bering Sea, Birnik, Punuk, and Dorset" (p. 225-6). Also after the appearance of the Ipiutak report he considered Ipiutak "the oldest known culture stage in Alaska" (1950, p. 27). When Arnold and Libby in 1950 published a series of radiocarbon dates from Alaska which seemed to indicate that Okvik is 1300 years older than Ipiutak [9], without questioning the correctness of the Okvik date of 2258 plus or minus 230 years, based upon one sample of driftwood, he used it as archaeological evidence in his attack on "the Larsen-Rainey conception." Let us first consider the archaeological evidence. When we placed Ipiutak and Near Ipiutak, as shown in table 2 (Larsen and Rainey, p. 155), as contemporary with Okvik and partly with Old Bering Sea it was because in Ipiutak houses and burials we found seven typical Okvik specimens and what seem to be two fragments of the so-called winged objects [10]. These specimens do not belong in the Ipiutak culture and, because some of the Okvik specimens in every detail are identical with Okvik specimens from St. Lawrence Island in the collections of the Alaska University Museum, there can be no doubt about it that the Point Hope specimens came from that island. This can only mean that the Ipiutak village and St. Lawrence Island were inhabited at the same time and that the two peoples were in contact with each other. There was apparently also contact during the Old Bering Sea period as indicated by the presence of the winged objects but that does not change the fact that Ipiutak and Okvik were contemporary, and that in Ipiutak there are many more close parallels with Okvik than with Old Bering Sea. That Ipiutak existed relatively unchanged all during the Okvik and Old Bering Sea periods is not unlikely [11]. In the eastern Arctic we have a parallel example in the Dorset culture which, according to Collins, must have left Alaska more than 2000 years ago (1953, p. 199) and yet we find it mixed with Thule types from the 13th and 14th centuries [12]. If we here use Collins' "archaeological evidence" we would have to date Dorset according to the latest Thule type found with Dorset specimens. It just shows that two culture complexes can exist relatively unchanged in the same region over a long period of time. Regarding the radiocarbon dates, I would like to add that though the Ipiutak dates were later than we expected, 912 plus or minus 170 years for Ipiutak grave no. 51 and 973 plus or minus 170 for the Ipiutak site at Deering (Larsen 1951 and 1953) it is indicative that the two dates are so close [13]. I question the Okvik date, however, because a piece of driftwood might be considerably older than the house in which it was used, and until more samples are dated I prefer to stick to archaeological evidence.

Can Okvik be contemporary with and at the same time an outgrowth of Ipiutak? We believe so and if not in the form as known from Point Hope then in "another, possibly older phase" (Larsen and Rainey 1948, p. 151), and we know today of several phases of the Ipiutak complex. The phase, however, could not be very different from the Ipiutak village because we have found so many close parallels in this with Okvik that they must be related [14]. The question is: What kind of a relationship? We believe Ipiutak is the parental culture and offer the following arguments [15]. Even Collins must admit that it is the more primitive of the two, being prepottery, preslate, and with the extensive use of side blades, otherwise I do not understand why he repeatedly refers to Ipiutak when he wants to demonstrate the relationship between Eskimo culture and European Mesolithic and Siberian Neolithic (1943, p. 225, 1950a, p. 2, and 1951, p. 437), and in his latest article he again had to resort to Ipiutak in order to show the relationship between Denbigh Flint complex and Eskimo culture (1953, p. 201) [16]. He cannot use "the Old Bering Sea culture" because in it the old traditions are fading out and the new elements make it too advanced. The neo-Eskimo culture developed over a long period of time and the earliest stage must of course have many points of resemblance with the paleo-

Eskimo stage from which it developed. Okvik is the transitional stage with some of the old features left but with enough new elements to be considered neo-Eskimo. It has many chipped stone tools but on the other hand the rubbing technique is fully developed (Collins 1937, p. 334) and most of the stone tools are of slate, either rubbed or chipped. We see how the old technique is used on the new material, argillaceous slate, which gradually replaces the harder minerals, just as on St. Lawrence the rubbing technique replaces chipping. The Okvik house has the central fireplace but a stone-paved floor like the neo-Eskimo houses (stones are not used at all in the construction of Ipiutak houses). Side blades do not occur in arrow and lance heads, only in harpoon heads. In Ipiutak we also found some types of implements which we consider prototypes of typical Eskimo implements and which occur in the typical form in Okvik. The characteristic ulo has in Ipiutak the semilunar blade placed in the side of a long handle; in Okvik we have the ordinary ulo, a transitional form with a short side grip, and the Ipiutak type. The prototype of the common composite knife, a knife not entirely split in two halves, is predominant in Ipiutak while in Okvik the ordinary type is the more common. In this connection we must not forget that these knife handles were used with metal blades not only in Ipiutak but also in Okvik and Old Bering Sea (Rainey 1941, p. 504, Collins 1937, p. 146). Collins seems to have forgotten it because when speaking about iron in 1950 he says, "Its presence has been proved for the Thule-Punuk stage on St. Lawrence Island, Alaska (Collins, 1937, pp. 29, 180, 237, 304) and it now appears that the Ipiutak, the oldest known culture stage in Alaska, used iron exactly the same way" that is, for the tips of engraving tools and the smallest knife blades (Collins, 1950b, p. 27, footnote). Returning to the prototypes I also consider birch bark containers, found in great numbers at Deering, the prototype of baleen buckets and the Ipiutak art, though obviously related to Okvik and Old Bering Sea art, contains more original features like the extensive use of animal motifs and the many examples of transition from realistic to geometric design than do the latter. Last but not least the absence in Ipiutak of the twenty (neo-Eskimo) culture elements mentioned before does not only imply that Ipiutak belongs to another culture complex than Okvik, but also to an earlier [17]. When Collins questions the dissociation of Ipiutak and "Old Bering Sea" and at the same time considers the latter as the older, it is up to him to explain why these elements occur in Eskimo culture before and after but not in the Ipiutak culture.

Archaeological problems are not solved in discussions but by excavations. With the extensive and well preserved finds from Point Hope and Deering, the Ipiutak culture is one of the best documented prehistoric Eskimo cultures. Unfortunately this does not hold good of the "Old Bering Sea culture." In the first place we do not up to this day have a single pure site of the Old Bering Sea phase (or is it actually two phases as indicated by Collins' style 2 and 3?). Secondly it is evident from Rainey's publication of the Okvik material from the Punuk Islands that there are at least two quite different styles of ornamentation, a simple and a more elaborate (Rainey 1941) and because there seems to be a connection between the types of harpoon heads and the style of ornamentation there is reason to believe that Okvik eventually will be divided in two or more phases. When these problems have been solved and more archaeological material is available from St. Lawrence Island, as well as radiocarbon evidence for dating, I am sure all discussion about the relationship and relative age of the Ipiutak and Old Bering Sea cultures will be superfluous. Therefore I suggest we lay down the pen and pick up the spade.

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November, 1953.

THE POSITION OF IPIUTAK IN ESKIMO CULTURE — REPLY

The greater part of Larsen's paper is a restatement of the Ipiutak theory rather than a reply to my two specific criticisms. I feel that this theory is based on a series of questionable assumptions rather than facts, but as Larsen properly insists on "sound scientific documentation and not mere statements" I will not attempt to discuss the theory as a whole in the space available here but refer to a recent publication which gives my views (Collins, 1954, pp. 78-85). The second half of Larsen's paper deals for the most part with the second of the two points I raised, the relationship of the Ipiutak and Old Bering Sea cultures. This is a crucial point for the Ipiutak theory, for if I am correct the type culture of the "palae-Eskimo" complex, from the evidence of both archaeology and radiocarbon dating, is later than cultures assigned to the "neo-Eskimo" complex and also more closely related to them than to other "palae-Eskimo" cultures.

My first point was that if Ipiutak was the type culture of a palae-Eskimo complex ancestral to all other Eskimo cultures ancient and modern, it could not at the same time have been a recently transplanted, late Iron age Siberian culture whose carriers had migrated directly from the lower Ob and Yenesei rivers to Bering Strait, a distance of over 3,000 miles, as late as the first half of the first millennium A.D. To me such an idea was and is incredible. Larsen now reminds me [5] that after the discovery of the Denbigh Flint complex he had "discussed the possibility that the Ipiutak culture could have originated in Alaska in which case the Asiatic parallels must be the result of intimate culture contacts across Bering Strait." In the paper referred to however this possibility is contingent on whether future study of the Ipiutak skeletons shows "that the Ipiutak people were natives of America and not immigrants from Asia. . . . If on the other hand the question of the origin of the Ipiutak people is left open, I still consider a migration from Asia at the beginning of our era a strong possibility" (Larsen, 1952).

My second point was that a number of typical Ipiutak houses and graves also contained typical examples of Old Bering Sea art and implements, whereas no diagnostic Ipiutak material has been found at the dozen or so Old Bering Sea sites known in Siberia and Alaska. The Old Bering Sea types at Point Hope could hardly be explained as merely the result of contact for they form an important and integrated part of the Ipiutak culture and there is no indication whatever of Ipiutak having influenced Old Bering Sea. Two of the Old Bering Sea objects at Ipiutak — fragments of ivory "winged objects" — were of particular importance. They are one of the most striking and diagnostic features of the Old Bering Sea culture, known on St. Lawrence Island in a number of related, sequential forms beginning in the Okvik stage and continuing through Old Bering Sea into Punuk. The two Ipiutak fragments were of the later, fully developed Old Bering Sea forms. The Ipiutak houses in which they were found must have postdated the culture stage on St. Lawrence Island of which this form was characteristic, to say nothing of the earlier stage (Okvik) before this particular form had evolved. I concluded therefore that the presence at Ipiutak of these two objects and numerous other examples of Old Bering Sea art and implement types, and the corresponding absence of Ipiutak material at Old Bering Sea sites, indicated the prior existence of Old Bering Sea and could not be reconciled with Larsen's and Rainey's view that Ipiutak was ancestral to Okvik-Old Bering Sea. Larsen now also recognizes the importance of these two fragments of winged objects (but only as indicating contact between the two cultures), for he says [10] that when Ipiutak and Near Ipiutak were placed as contemporary with Okvik and partly with Old Bering Sea "it was because in Ipiutak houses and burials we found seven typical Okvik specimens and two fragments of what seems to be one of the so-called winged objects. . . . There was apparently also contact during the Old Bering Sea period as indicated by the presence of the winged objects. . . . ." The Ipiutak report, however, was by no means as explicit as this. Though there is not the slightest doubt as to the nature of these objects, they were described, opposite Pl. 27, as "Fragments of Winged Objects (?) . . . Classification uncertain." The text (p. 142) makes no mention of their being winged objects nor of their identification with Old Bering Sea, and the decoration is described as Okvik, not Old Bering Sea. The single reference (p. 152) to the possibility of contemporaneity between Ipiutak and Old Bering Sea, shown by the presence of Old Bering Sea features, including art, at Point Hope, is counterbalanced by statements on pp. 142 and 168 that no indisputable examples of Old Bering Sea art or artifacts were found at Ipiutak.

Though recognizing that Ipiutak was in contact with Okvik and Old Bering Sea, Larsen adheres to his original view that ". . . the Okvik phase and the whole Arctic Whale Hunting Culture were based on a foundation of Ipiutak culture, either in the form as known from Point Hope or another, possibly older phase" (p. 151). For the reasons given I feel that the Ipiutak culture as found at Point Hope cannot have been ancestral to Okvik-Old Bering Sea. As to "another, possibly older phase" of Ipiutak I have no information. Okvik was of course an outgrowth of some older culture but I see no reason for labeling it Ipiutak or anything else in advance of its discovery.

For the benefit of those who are not Eskimo specialists it might be mentioned that Larsen's statement [1] that "it was not until the discovery of the Ipiutak culture that the idea of a stratification in Eskimo culture was taken up again" refers to the hypothetical stratification of culture stages proposed by Steensby and Birket-Smith. I mention this because of a prevalent tendency for archaeological works to be evaluated on the basis of the authors' use of particular terms rather than on content. Every major work in Eskimo archaeology has been concerned with stratification — with the demonstration of cultural sequences and relationships—though no one prior to Larsen and Rainey had sought to revive this particular hypothetical structure which to date has received no support from the evidence of archaeology, linguistics or somatology.

Larsen's remarks [2] on my objection to dissociating Ipiutak and Old Bering Sea might lead one to suppose that I did not recognize the important differences between them. I have always recognized, and emphasized, these differences but have pointed out that on the other hand there were so many striking similarities that the two cultures were in some way related. In fact there are more (and much closer) resemblances between Ipiutak and Okvik-Old Bering Sea than between Ipiutak and any member of palae-Eskimo complex. The following are some of the Ipiutak features that are also present either in identical or closely related forms in Okvik-Old Bering Sea: An elaborate art style with some of the most typical Ipiutak objects bearing typical Old Bering Sea ornamentation, specialized forms of harpoon heads, socket pieces and foreshafts, arrowheads and points, bird arrowheads, salmon spear barbs, side and end bladed knives, adz heads and blades, engraving tools, cup-shaped scrapers of ivory, mattocks, shovels, cannon bone scrapers, picks, flint flakers, flaking hammers, ivory hooks, buttons, brow bands, rings, snow goggles, ivory chains, marlin spikes, chipped stone blades such as side and end scrapers, drill points, knife blades, gravers, and slate implements with rubbed edges. These features form an integral and important part of the Ipiutak culture. What I object to is minimizing them or explaining them as only the result of contact while at the same time regarding Ipiutak as the ancestral culture. The similarities and differences between Ipiutak and Okvik-Old Bering Sea suggest to me that they were related cultures, neither of them directly descended from the other, but from a common source which was probably a stage of culture related to the Denbigh Flint complex and intermediate in time between it and Okvik.

The "neo-Eskimo" or "Arctic Whale Hunting Culture" is an entity, a cultural continuum comprising sequent stages of a maritime form of Eskimo culture — Okvik, Old Bering Sea, Birnirk, Punuk, Thule, modern north Alaska and Greenland. It possesses the one feature essential to such a cultural aggregate, demonstrable genetic relationship of the included parts. I do not believe that the same can be said of the Ipiutak or "palae-Eskimo" complex. The cultures which both Larsen and I recognize as outside the "neo-Eskimo" complex — Dorset, Kachemak Bay, Aleutian, Southwestern Alaska, Central Canada — exhibit varying degrees of resemblance to Ipiutak (some of them also to neo-Eskimo); some of these resemblances are significant and indicate relationship of some kind, others seem doubtful. The evidence for interrelationship between the members of the Ipiutak complex is in some cases strong, e.g., Dorset, in others tenuous, e.g., Caribou. On the whole, however, there is nothing approaching the close continuity and cohesiveness that has been demonstrated for the "neo-Eskimo" groups.

In some respects Larsen's point of view and mine should not be too difficult to reconcile. My basic objection is to placing all known forms of Eskimo culture in two rigid, sharply defined and mutually exclusive categories, a classificatory procedure which from its very nature must ignore the ever present phenomenon of cultural intermingling and other factors responsible for culture growth and change. While I feel that a theory of this kind must inevitably do violence to cultural facts I can agree with Larsen on some of the premises on which it is based. Larsen's revised and simplified definition of a palae-Eskimo culture (1950) as one in which chipped stone predominates over rubbed slate is certainly valid though it represents no great advance over previous knowledge that all of the older Eskimo cultures, including Okvik-Old Bering Sea, made more extensive use of chipped stone than did most later cultures. And if this generalization is formalized in terms of a rigid classification it can result in such inconsistencies as placing the modern Sadlermiut, supposedly the last remnant of the Thule culture, in the palae-Eskimo complex because they used only chipped stone implements. Larsen and I both recognize two basic types of prehistoric Eskimo culture, the series of closely related sequential phases which he calls "neo-Eskimo" and another series of cultures — Dorset, Kachemak Bay, Aleutian, and Ipiutak, which he calls "palae-Eskimo." It remains to be proved, however, that all members of the palae-Eskimo complex are related to each other, that they are all essentially inland in orientation (even the Aleutian Islanders!), and that they represent an earlier type of culture than that of the "neo-Eskimos."

The discovery of the Denbigh Flint complex at Cape Denbigh on Norton Sound should give pause to those who are still insistent on tracing Eskimo culture to an inland source. There can be little doubt, it seems to me, that Denbigh was one of the primary sources of Eskimo culture, and Larsen seems inclined to the same view. It was a coastal culture and we may probably assume that like other Mesolithic cultures it utilized the resources of both land and sea. However, it was not restricted to the coast, for a closely related culture which on typological grounds seems somewhat later, had established itself at Anaktuvuk Pass and other localities in the Brooks Range in interior Alaska, and similar cultures are known to have existed in the interior of Siberia (Okladnikov, 1950). The present evidence seems to me to indicate that the Dorset culture had its origin in the Denbigh Flint complex or something closely similar, that it moved eastward not along the coasts but through the interior of Alaska and Canada and finally emerged in the form we know it — a coastal culture — around Hudson Bay. The earliest Arctic cultures were thus adapted to both a coastal and inland environment. The oldest Eskimo cultures of which we have knowledge in Alaska, those on the Aleutian, St. Lawrence, and Diomede Islands, were of necessity maritime; with access to unlimited supplies of food from the sea, they were the only Eskimos who did not hunt caribou. On the Alaskan mainland all coastal groups without exception, both "neo-Eskimo" and "palae-Eskimo" hunted caribou as well as seals; and wherever they lived in the vicinity of large rivers they extended their settlements up stream where, in addition to salmon fishing, they had easier access to caribou. One of the most serious flaws in the Ipiutak theory is the wholly mistaken idea that only inland Eskimos or those of inland origin — the "palae-Eskimos" — hunted caribou, while the coastal "neo-Eskimo" clung to the sea coast hunting seals, walrus and whales.

Larsen criticizes me for dating Ipiutak on the basis of the latest material found at the site. This would be comparable, he says [12], to considering the Dorset culture as coeval with Thule because it is "mixed with Thule types from the 13th and 14th centuries." This is hardly a valid comparison. In the first place, I do not know on what basis the Dorset culture can be said to be mixed with Thule. Dorset and Thule material is often found at the same site, and where no attempt is made to observe the relative position of the artifacts or if these are obtained secondhand from Eskimos, "mixture" is to be expected. Jenness' original description of the Dorset culture was based on his recognition of an age difference between these deeply patinated and typologically distinctive artifacts and those of the Thule culture, which the Eskimo diggers had indiscriminately mixed. The only carefully excavated Dorset site at which Thule material was found in place is the one on Mill Island recently excavated by Deric O'Bryan. This particular site must be recognized as post-Thule, but this does not date the Dorset culture as a whole. Thule material was not found at the Dorset sites excavated by Rowley, Leechman, Harp, or Knuth. Holtved found Dorset material underlying Thule in northwest Greenland, as I did at Frobisher Bay and Cornwallis Island where the two cultures were separated by old buried sod lines. Present indications point to a long time span for the various phases of the Dorset culture and those preceding it in the eastern Arctic, ranging from what might be called a Denbigh-Dorset phase in Disko Bay, probably 2,000 years old or more, to the Dorset-Thule phase of less than 1000 years ago. The only way the single Ipiutak site could be equated in age with the Dorset culture as a whole would be to assume that it had been occupied over a very long period. If there were stratigraphic evidence of this or if the Ipiutak artifacts pointed to a significant age difference between the houses, I would certainly not have been justified in dating the entire site from material found only in some of the houses. But there was no stratigraphy at Ipiutak nor anything to suggest that one house was appreciably older than another. The Ipiutak report is explicit on this point: "the artifacts found in the houses are so uniform that it is impossible to detect any cultural differences in the houses, despite our efforts to excavate in all parts of the village. . . . Not only the excavations but the study of the material found in the Ipiutak houses and burials produces an impression of great uniformity in this culture. The variation in house construction is negligible, and most of the burials fall within the pattern of two standard types. But the outstanding contributory factor to this impression is the uniform character of the finds which ties not only all the houses but the houses and burials into a single unit" (Larsen and Rainey, 1948, pp. 47, 162). Despite this cultural uniformity Larsen believes [11] "That Ipiutak existed relatively unchanged all during the Okvik and Old Bering Sea periods is not unlikely." But here again conditions at Ipiutak point to the opposite conclusion. The houses were arranged in long rows, none of them overlapping or superimposed. Moreover it is stated that "the floor deposit in most houses was so thin that they were undoubtedly occupied for a very brief period, probably a single season" (Larsen and Rainey, 1948, p. 47). If we assume that no more than 20 of the 600 to 700 Ipiutak houses were occupied simultaneously (surely a minimum estimate) the total period of occupation would have been less than 40 years. I do not suggest that Ipiutak was of such short duration for undoubtedly many houses have been washed away by the sea. I believe, however, that it is wholly unrealistic to contend that the Ipiutak culture as known at Point Hope had a time span comparable to that of the whole Dorset culture or that it existed throughout the entire Okvik and Old Bering Sea periods, when one of the Okvik middens alone reached a depth of 6 feet.

Larsen is correct [6] in assuming that I meant Point Hope Ipiutak when I said I doubted "that Ipiutak, strongly influenced as it was by late bronze-and iron-age cultures of Eurasia, was older than and ancestral to all

other known forms of Eskimo culture." Larsen's criticism of my assigning this role to the "Ipiutak culture in the form it was found at Point Hope" implies that some other members of the complex may have been older than Point Hope Ipiutak. This may be his present view but no such statement is to be found in the Ipiutak report. Wherever there was discussion of the relative age of Ipiutak and some other culture, Ipiutak was said to be the older, and in the chronological table (p. 155) it is placed as the oldest culture.

Larsen now excludes the Caribou Eskimo from the list of cultures descended from the Ipiutak or palae-Eskimo complex, assigning them an older status as "surviving Paleo-Eskimo" [7]. His position is thus close to that of Birket-Smith who, however, regards the Caribou not as palae-Eskimo but as proto-Eskimo. The Point Hope excavations produced no new evidence to sustain the Caribou Eskimo hypothesis. On the contrary the Caribou possess fewer Ipiutak features than any other Eskimo group: The tattoo pattern on the face, the swivel with central rotating part, the bone dagger and caribou lance. In fact, Larsen and Rainey included the Caribou Eskimos in the palae-Eskimo group not so much because of these few and rather unimpressive resemblances but because they were inland caribou hunters, as the Ipiutak people were supposed to have been, and because of a few additional traits they share with the Nunatagmiut, who are supposed to be the direct descendants of the Ipiutak people. There is one simple fact that outweighs all the finespun argument and speculation about the unique position of the Caribou Eskimo, and that is language. If, as assumed, this group has perpetuated a palae- or proto-Eskimo way of life in their present habitat isolated from other Eskimos, their speech might be expected to have retained some of its archaic features or at any rate to be in some degree different from that of their neighbors. However, their dialect is in no way exceptional; it belongs to the northern Eskimo language that Swadesh has named Inupik, which extends as a remarkably cohesive unit from Bering Strait to Greenland, a situation I have ventured to explain as having resulted from the eastward and westward movements of the Thule culture. Hirsch (n.d.) employing Swadesh's lexico-statistical method of measuring the degree of relationship between related languages, finds that the Caribou dialect does not differ significantly either from the dialects of other Central tribes or from those of the Thule-derived "neo-Eskimo" Alaskan groups.

Larsen makes something of a mystery of why I changed my opinion as to the age of Ipiutak [8]; he seems to imply that it was because of the radiocarbon dates announced in 1950, which I used as "archaeological evidence" for "attacking" the Ipiutak theory. I thought I stated the reason clearly (Collins, 1953) when I said that my original conclusion that Ipiutak was in part contemporaneous with and in part older than Old Bering Sea was based on the preliminary descriptions of the Ipiutak finds, whereas the full report (1948) which showed typical examples of late Old Bering Sea art and particularly the two fragments of winged objects, indicated the prior existence of the Old Bering Sea culture as a whole. Radiocarbon dating had nothing to do with it. In fact I questioned the accuracy of the late dating of Ipiutak and suggested that it was some 500 years older, making it "only a little later than estimated by Larsen and Rainey." The paper (Collins, 1950b) which Larsen cites as showing that even after the appearance of the Ipiutak report I still believed Ipiutak to be the oldest Eskimo culture was a report on field work conducted in the summer of 1948; it was written in the fall of 1948 for the 1948-49 Annual Report of the National Museum of Canada and was published in 1950. If Larsen wanted to know what my opinion was in 1950 (though I fail to see why this should have been of any great importance) it was given rather fully in the other paper of that date which he cites (Collins, 1950a), which was read at a meeting on April 27, 1950.

Larsen's remarks on radiocarbon dating [9, 13] are puzzling. He criticizes me for accepting the Okvik (early Old Bering Sea) date of 2,258±230 years because it was based on a single piece of driftwood which "might be considerably older than the house in which it was used." Of course it was older than the house itself — all house timbers are — but was it 1,300 years older? From what he says here Larsen would seem to think so, for he accepts the 917 and 973±170 year old dates for Ipiutak and yet insists that Ipiutak was ancestral to Okvik. The Ipiutak dates were also determined from driftwood. Is Ipiutak therefore many years later than the radiocarbon dates indicate? Unlike Larsen, I still believe that the Ipiutak dates are too recent; the fact that the two dates are so close might only mean that conditions at the two sites were similar — both seem to have been shallow unfrozen sites in loose sand or gravel into which grass roots may have penetrated. On the other hand I accept the Okvik date, not so much because it closely coincides with the 250 B.C. date I had suggested (Collins, 1940, chart p. 545) but because it is consistent with the archaeological evidence as I interpret it. In this connection it might be well to recall the impressive indications of age at all of the Okvik sites — the dark brown color of the bone and ivory artifacts wherever found in contrast to the lighter color of the Punuk material; the absence of house depressions or other surface indications at any of the sites; and the fact that at the Hillside site at Gambell the upper 12 inches of soil, which thaws in summer, contained only stone implements and potsherds, organic material being preserved only in the permanently frozen ground below that level. In contrast, the Ipiutak house pits are still discernible as "shallow rectangular depressions" in which water or melting snow remains until July; and though the site thaws from top to bottom in summer, wood, bone and ivory are all preserved.

Larsen's acceptance of the very late radiocarbon dating for Ipiutak and his continued insistence that

despite this Ipiutak was ancestral to Okvik and the whole "neo-Eskimo" culture represents a more extreme view than that of the Ipiutak report, and leads to some remarkable conclusions. Giddings has tree ring dates of A.D. 1202 to 1242 for Ahteut, a Kobuk River site which contains harpoon heads identical with typical fully developed Punuk forms on St. Lawrence Island. This means that if the radiocarbon dating is correct Ipiutak was only about 250 years older than fully developed Punuk and all of Old Bering Sea and Okvik! Also, according to the radiocarbon dates the Ipiutak site at Point Hope was occupied around the time — A.D. 982 — when the Norse were colonizing southern Greenland. Yet we know from Mathiassen's and Holtved's excavations that the Norsemen, probably only 200 years later, were in contact with the Thule Eskimos, representatives of the latest prehistoric stage of neo-Eskimo culture. This would mean the neo-Eskimo culture arose, ran its full course of development through its various distinctive stages — Okvik, Old Bering Sea, Birnirk, and Thule — and spread from Alaska to Greenland in the first few centuries following the Norse settlement of Greenland. Larsen would no doubt avoid any such impossible interpretation by assuming that the radiocarbon dates for Ipiutak were terminal dates, and that somewhere there may have existed an earlier form of Ipiutak culture (but one differing little from the Point Hope pattern [**14**]) which continued relatively unchanged over a long period of time. A theory, however, should rest on something more than suppositions.

The reasons Larsen gives for thinking Ipiutak ancestral to Okvik [**15**] are, again, suppositions: (1) Okvik and Old Bering Sea possess 20 traits [**3**] that are lacking in Ipiutak; therefore they must be late. (2) Ipiutak lacks pottery and slate; therefore it belongs to a "pre-pottery, pre-slate" stage of culture. (3) Three Ipiutak traits — the ulu, composite knife handle, and birch bark containers — are considered to be more primitive typologically and the prototypes of Okvik-Old Bering Sea forms; however, this number must be reduced to two, for the predominant Ipiutak type of composite knife handle also occurs in Thule and modern Alaskan Eskimo culture. (4) Ipiutak art possesses more "original" features such as the more extensive use of animal motifs and many (supposed) examples of transition from realistic to geometric design. (5) Ipiutak is more primitive and earlier because of its highly developed flint technique (no rubbed slate) and its use of side blades, a Mesolithic feature.

In the first two instances the argument is simply one of assigning temporal significance to the absence of a trait[**4, 15**]; e.g., the absence of pottery and rubbed slate at Ipiutak means that these had not yet come into use in the Bering Strait area. The corollary assumption is one that denies the possibility of selectivity in cultural borrowing. Thus we read in the Ipiutak report (p. 151): ". . . the Okvik phase includes a number of significant elements (those listed [**3**] by Larsen) which persisted until recent time, but which do not occur in the Ipiutak culture. . . . If the Okvik phase preceded Ipiutak, it is incomprehensible why even the most essential of these elements, such as slate, pottery, whaling, and the sled, were not adopted by the Ipiutak culture." However, this test was not applied in the opposite direction, for Larsen and Rainey (p. 154) also cite a number of Ipiutak features that have continued in use among the modern Eskimos from Norton Sound to the Alaska Peninsula. If Ipiutak had preceded Okvik, this would mean according to Larsen's definition [**16**], that these traits had "occurred in Eskimo culture before and after but not in" the Okvik phase. And in that case it would be just as pertinent to ask why they had not been adopted by Okvik. This line of reasoning ignores the highly important phenomenon of provincialisms in Eskimo culture, or indeed in culture in general, and if carried to its logical extreme would mean that there would be no such thing as regional patterns of culture. There are many examples of sharp cultural divergencies among neighboring groups of Alaskan Eskimos. For example the dog sled is scarcely known on Nunivak Island. Labrets, in common use from the Arctic coast to South Alaska, were never adopted by the St. Lawrence Island or Siberian Eskimos though used on Diomede Island only 18 miles away. Arrowshaft straighteners, the peculiar form of skin scraper with finger grips, and chipped stone arrow and harpoon blades, all characteristic of the Barrow-Point Hope-Kotzebue region, did not extend to Cape Prince of Wales, even though the Wales people maintained close trade relations with these other Eskimos. There are many other elements of culture among the Eskimo that are thus narrowly restricted in their range. Therefore, in replying to Larsen's question [**17**] I may say that I see no reason why Ipiutak should inevitably have adopted 20 traits which Eskimos on St. Lawrence Island had possessed from Okvik times onward to the present.

Larsen is correct in pointing out that in its extensive use of side blades Ipiutak is more primitive than Old Bering Sea where these are restricted to harpoon heads. As he says [**16**], I have repeatedly cited the Ipiutak flint industry and particularly its use of side blades as evidence of a relationship between Eskimo culture, the Denbigh Flint complex, and the European Mesolithic and Siberian Neolithic. It does not follow, however, that because Ipiutak is more primitive and old-fashioned in this respect it must be older than Old Bering Sea. The explanation, I believe, is to be found in cultural lag and the marginal character of Arctic culture in general (Collins, 1943, 1951, 1953, 1954). Even if Ipiutak were as old as Larsen and I originally believed, it would still

have been several thousand years later than the European Mesolithic and early Siberian Neolithic which it so closely resembled in its flint techniques. Ipiutak is not the only example of the late survival of ancient culture traditions among Arctic peoples. The Denbigh Flint complex, now dated by radiocarbon at around 3,000 to 2,000 B.C., and with a stone technique of Neolithic character, also possessed typical Aurignacian burins. At early Neolithic sites in Siberia the same types of stone implements, including burins, are found in association with pottery. And the Dorset culture in Canada and related phases in Greenland continued to use burins at an even later time.

I share Larsen's belief that the combined efforts of many workers will be needed to solve the intricate problems of Eskimo archaeology and that it would be highly desirable if we could all pull in the same direction. I believe, however, that the problems will appear in truer perspective if new finds are themselves treated as individual problems to be interpreted in the light of the total factual evidence rather than on the basis of a highly elaborate theoretical structure which rests, I feel, on unproved assumptions and which in facile manner has solved in advance many of the important problems we should be attacking.

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April, 1954.

USE OF INFRARED PHOTOGRAPHY IN ARCHAEOLOGICAL FIELD WORK *

Photographic emulsions sensitized to wave-lengths of radiation in the infrared region of the spectrum have been used in technical studies for a number of years. During excavation of the Barbeau Creek Rock Shelter, in Randolph County, southern Illinois, in 1952 and 1953, I experimented with infrared films, taking pictures of profiles in the site. The midden in this shelter consisted largely of a light, dun-colored loess which came from the tops of the bluffs in the area. Ordinary photographs of the profiles in the midden are dull and without sufficient contrast between features to be useful for analytical purposes. The possibility of making dramatic, high contrast prints from infrared negatives is well known. For this reason photographs of the profiles were made with infrared film. The results the first season were promising. Not only did features in the profiles show up clearly on the prints, but some appeared which were not visible in prints made with panchromatic film and which were not apparent to the eye.

* The excavation of the Barbeau Creek Rock Shelter was sponsored by the Illinois State Museum, the Department of Anthropology of the University of Chicago, and private benefactors. Essential support was given by J. Charles Kelley of Southern Illinois University and Fred Matson of Pennsylvania State University. This support is herewith gratefully acknowledged. I am also indebted to my colleague, Howard Winters, who first pointed out to me the bands in the prints made from infrared negatives of the west profile.

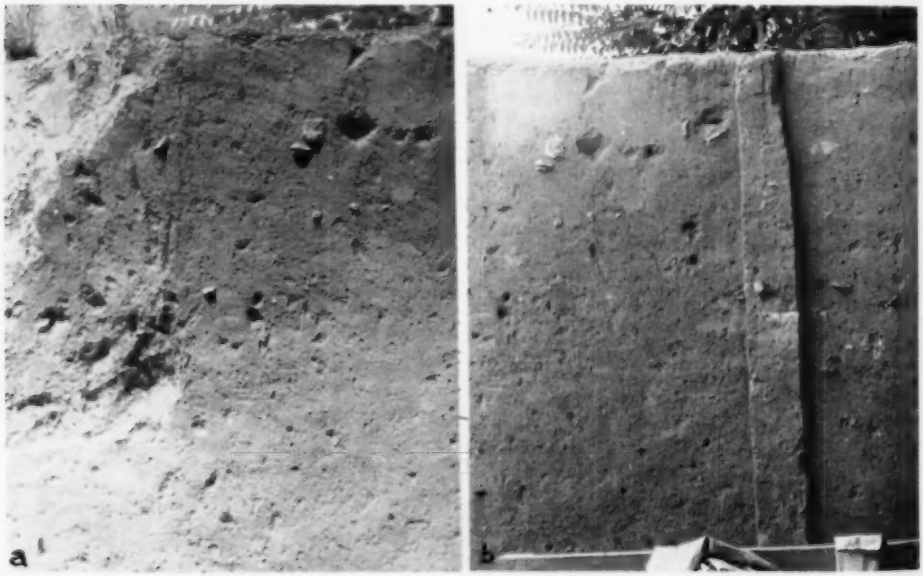

FIG. 31

During the second season more extensive experiments were undertaken. A careful record of the same profiles on both panchromatic and infrared sensitive film was made. Photographs were made with illumination from infrared and white No. 50 G-E bulbs on Eastman's infrared film and Eastman's Super Panchro Press type B film. Details on processing the film should come from instructions packaged with it, as changes in recommendations from Eastman can be expected shortly. Greater detail on apertures, exposure times, etc., is not provided here because infrared film must be tested in each particular situation. Focusing can be a particularly annoying problem, since infrared radiations do not focus in precisely the same plane as visible radiations, and the correction factor depends upon the type of lens used. Another difficulty arises from the fact that the quantity of infrared radiation which will be reflected by a particular surface cannot be predicted with certainty until test exposures have been made.

The advantage of using the two emulsions together became apparent at once. First, features which were not recorded by the panchromatic emulsion, appeared on the infrared film. Second, the infrared negatives produced prints providing very clear definition and separation of strata and features within the different strata. This was a far better separation than that on the prints made from panchromatic film. The basic reasons for this definition and separation probably are the high contrast property of infrared emulsions and the distinct differences in the amount of infrared radiation reflected by the different components in the strata.

Figure 31, *a* is an infrared photograph of a section of a profile at the west end of the site. The faint lines which run through the profile in this picture do not appear in Figure 31, *b*, which is a photograph made on panchromatic film of the same section of the same profile. An hypothesis about the significance of these lines is discussed below.

A second advantage of the infrared film is demonstrated by the photographs in Figure 32, in which *a* was made from an infrared negative, and *b* was made from a panchromatic negative. I did not discover any features in these infrared prints which are not visible to the eye or which do not appear in the prints made from panchromatic film. However, the infrared pictures show a high degree of contrast between different features in the profile. The various strata are clearly distinguishable; the borders of each line and stratum in the profile are quite clear; the charcoal flecks which occur throughout the site are sharply defined, and the fragments of limestone which were scattered in all sections of the site stand out clearly. It is unfortunate that the angle of the flash was slightly different in the two instances, which resulted in slight differences of shadow detail. The infrared flash came from slightly below the plane of the lens; the white flash came from above and to the right. The prints chosen for publication came from a series which included a number of variations in method of exposure. When the panchromatic film was exposed through a red filter no significant difference was noted, whether daylight or flash was used or whether infrared flash bulbs were used.

FIG. 32

The major differences between photographs made with flash exposure or daylight exposure was in the sharpness and clarity of detail.

An interpretation of the faint lines noted in Figure 31, *a* is that they are due to the manner in which the midden was built, which in turn can be related to hypotheses about climatic conditions prevailing during the period when the site was occupied. The site lies under an overhang of the sandstone-limestone bluffs which rise from the bottom lands of the Mississippi River in southern Illinois. The tops of the bluffs are capped with deposits of dun-colored loess 150 to 300 inches deep (Smith 1942, pp. 152-3). The bottom land is alluvial soil, usually of a darker color than the loess. Except for these deposits against the bases of the bluffs, loess does not ordinarily occur on the bottom lands. The lines in these infrared prints are taken as evidence that the loess sifted down from the tops of the bluffs during a period, or periods, in which an arid climate prevailed. I take the lines in the photograph as evidence of bands of soil of slightly different composition in the midden. The lines probably represent a difference either in size of soil particles or in physical-chemical composition, or both; different types of soil reflect different amounts of infrared radiation. If this proves to be a reasonable hypothesis, these bands are analogous to the varves found in strata cut from glacial lake beds. It is reasonable, I think, to relate the differences in soil particle composition appearing in this manner in the midden to cyclical differences in climate. For reasons briefly discussed below it is probable that the prevailing climate was arid during a large part of the site's history. However, there may have been periods of increased humidity and rainfall, seasonal, or at greater intervals. During such periods of increased humidity and rainfall the tops of the bluffs would have been covered with a mantle of vegetation denser than before. In such periods most of the soil would have been held to the tops of the bluffs as it is at present and either the lighter particles or those from less fertile sections would have blown around and drifted to the base. The lines appearing in the prints made from infrared negatives do not appear to continue to the deepest sections of the profiles but coincide with the upper section of the site and seem to stop at a major discontinuity in the site, between the dun-colored loess and a heavier, darker soil.

Support for the hypothesis that the midden was built during dry periods comes from other data taken from the site and consideration of other environmental factors. Throughout the site, thick, wide beds of white ash occur. This ash appears to be the residue of material which has been completely burned. Jennings (personal communication) describes a similar situation in Danger Cave, and his interpretation undoubtedly fits the ash beds in the Barbeau Creek Shelter. He hypothesizes that the ash is the remains of fires made of grass, shrubbery, and other light vegetation characteristic of semidesert conditions. Large pieces of partially burned wood are scarce at the Barbeau Creek Shelter but are found occasionally. The assumption is made here that this scarcity is evidence for very infrequent use of wood for fires by the prehistoric inhabitants because of a prevailing desert or semidesert flora. Today the bluff tops and bottom lands are heavily wooded and covered with dense growths of small trees where they are not under cultivation.

A check on the foregoing hypothesis is possible from the interpretation of other materials discovered at the site. Snail shells were found throughout, not only the large varieties but also thousands of minute snail shells which were mixed with the soil and discovered only after the soil was examined with a hand lens. Soil was saved from all levels in the site so that a good sample of snail shells is on hand. Snails are considered to be very sensitive to humidity and the change in species and varieties from the bottom to the top of the site may be used to check my hypothesis about climate. A more detailed discussion of this subject is presented in a forthcoming preliminary report on the site.

The usefulness for anthropological research of infrared emulsions is not restricted to the sort of work reported in this note. Archaeologists might find it profitable to adopt aeriel infrared films for topographic surveys, a use which has been important in the work of various United States government agencies. The special properties of these emulsions have been exploited in botanical research on ecological and topographic problems of relevance to anthropologists (Ives, 1939; Obatan, 1941). The study of fossils occurring in certain kinds of strata is simplified when infrared photography is used, as is analysis of textile weaves from samples of deteriorated matted or bunched cloth in which the weave is obscured (Clark, 1946). Bloch (1932) photographed Negroes by visible and infrared radiations, discovering marked differences in the infrared photographs. He interpreted these as indicating Mongoloid features in Negroes, but when Seligman reviewed Bloch's work in 1934 he reported that these differences are the expected ones in portraits taken with infrared radiations. Spuhler, in studies of genetic characters in human groups, has recently used Haxthausen's technique (1933) of photographing the superficial thoracic veins by infrared radiation. Search of relevant literature has not revealed any instances of use of infrared photography of bone, although an analysis of the infrared transmitting properties of horn sections was reported by Taylor (1933). Rowe (1953) reports a number of other uses of infrared photography of interest to anthropologists.

Infrared films should be interpreted conservatively, as Seligman's review of Bloch's work demonstrates. They are most useful when used with panchromatic photographs of the same subjects. Anthropologists will find that achievement of significant results from using this technique will be on a trial and error basis until the infrared reflecting and emitting properties of all substances are known.

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BOOK REVIEWS

Radiocarbon Dating. WILLARD F. LIBBY. University of Chicago Press, 1952. 132 pp. $3.50.

One of the most significant discoveries of the past decade was the existence of measurable amounts of carbon 14 in nature and its use as a method of absolute age determination. This achievement presents an excellent case history of the scientific method in action. Data on cosmic ray flux and neutron reaction accumulated during the late 1930's permitted W. F. Libby to calculate the concentration of natural radiocarbon. This concentration was below that readily measurable with existing techniques, but with his ingenuity and the help of E. C. Anderson and J. R. Arnold the necessary techniques were developed to test the theory. Within the limits of experimental error the data checked the theory, and the method of dating geological and archaeological objects for the recent geological past was made available.

Radiocarbon Dating contains an account of the method as developed in Libby's laboratories at the University of Chicago. The book is clearly and tersely written, giving all the necessary principles and procedures for either the archaeologist or geologist who wishes to interpret the results of the method, or for others who wish to set up the technique in their own laboratories. After a summary of the principles involved, the world-wide distribution of radiocarbon, the half-life data on carbon 14, and the details of the sample preparation and measurement are discussed. A list of all of the data obtained in the Chicago laboratory up to September 1, 1951, is given, with brief description of the samples. The book is concluded by a chapter on the significance of these dates, contributed by Frederick Johnson. The paper, printing, and binding are all of fine quality, and errors are practically nonexistent.

Since scientists in many fields are interested in the carbon 14 dating method, and since most of the literature is scattered through several journals, this book is a welcome compilation. It should be noted, however, that this field is developing with extreme rapidity. At the present time one other laboratory (Columbia) has been in full operation for three years. Michigan and Yale have been working for several years and other laboratories are starting at the University of Pennsylvania, University of Colorado, California Institute of Technology, U.S. Geological Survey and elsewhere. There have been almost as many additional samples dated as those reported in the book. The advances in technique are also proceeding rapidly, so that a number of problems noted in *Radiocarbon Dating* have been either solved or simplified. For example, at Columbia alone, the method has been extended to 30,000 years, it has been found that shell is generally useful, deep-sea water has been dated, the leaching process has been speeded up by a factor of ten, and samples as small as 0.5 gm. have been successfully measured. Two new methods of counting C^{14}, proportional gas counting of acetylene methane or CO_2, and liquid scintillation counting of ethanol aliphatic or aromatic hydrocarbons are under development. All of these techniques will increase both the range and precision of the dating method.

Such rapid strides are inevitable following an important discovery. *Radiocarbon Dating* is complete up to its date of writing, however, and is written with the authority of the scientist who developed the method. It is an indispensable volume for anyone seriously interested in historical science.

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A Brief Survey of the Lower Colorado River from Davis Dam to the International Border. ALBERT H. SCHROEDER. Reproduced by the Bureau of Reclamation, Reproduction Unit, Region Three, Boulder City, Nevada, December, 1952. 57 pp., 1 map, 6 tables, 31 figures.

An area which we usually consider as part of the Southwest, the Lower Colorado River Valley, has been, as far as archaeology is concerned, almost a blank space on the map. This seems strange because the region was reported relatively densely inhabited when the Spaniards visited it in the 16th, 17th, and 18th centuries. This lack of information is explained by the annual floods of the Colorado, which inundated the bottom lands, the only areas available, in a very arid region, for agriculture and human occupation. Every year, therefore, most of the evidences of occupation were obliterated; so the archaeologist has had little to work with.

The National Park Service is to be congratulated on having assigned to Schroeder the task of recording archaeological sites along the river before all of the bottom lands were covered by back waters of the numerous dams, and also for publishing the results. He was particularly well qualified to undertake the survey because he had previously made stratigraphic studies of a site at Willow Beach, now flooded with the waters of Davis Dam. The only previous work in the area was undertaken by Malcolm Rodgers, and this survey included a much wider area and was not concentrated on the bottom lands and immediately adjoining terraces.

Schroeder's paper consists of seven parts, including a description of the area, its environment and history, a description of pottery types, other material culture, description of seventy-four sites, time and culture correlations with other areas, and a summary of the results.

The evidences of human occupation, besides potsherds and a few stone artifacts, consisted of a few cremations, circular rock outlines that did not appear to be house sites, rockshelters, two shrines, bedrock mortars, and petroglyphs.

Most of the sites appear to have been farming sites and only a few large sites suggested permanent settlements. It is to be regretted that no architectural fea-

tures could be observed to round out the study. The annual floods and mild climate did not encourage well-built, permanent dwellings whose remains would leave a record.

In his revision of the pottery types previously described by Rodgers and by Colton, he introduces a new ware called Lower Colorado Buff Ware, replacing previously described Topoc Buff Ware. Although this is a much more appropriate name, there is a question as to whether it is advisable to introduce a synonym for that reason alone. If such a rule were generally followed, there would be utter confusion on southwestern pottery terms. Since his description of Lower Colorado Buff Ware considers additional types of temper, the new name is probably justified.

The author concludes that the valley of the Colorado River below Davis Dam was inhabited about A.D. 900 by an agricultural people who made paddle-and-anvil pottery and were probably Yuman speaking. It appears that the river bottoms were continuously inhabited, except for the periods of the annual floods, until the present time. Shell ornaments showed that the people had trade relations with those on the Pacific coast, and pottery fragments indicate trade with the Hohokam and the people of the plateau. Between A.D. 1100 and 1150, Schroeder believes, the evidence shows that the Shoshoneans settled in the northern part of the area, displacing the previous Yuman inhabitants.

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Kiva Mural Decorations at Awatovi and Kawaika-a, with a Survey of Other Wall Paintings in the Pueblo Southwest. WATSON SMITH. Papers of the Peabody Museum of American Archaeology and Ethnology, Volume 37. Cambridge, 1952. xxi, 363 pages, 92 figures, 9 color plates by Louie Ewing. $7.50.

Watson Smith's long awaited report has more than fulfilled the expectations of all those concerned with this most important phase of pre-Columbian Indian art. Far from limiting his thesis to the discoveries at the prehistoric Hopi pueblos of Awatovi and Kawaika-a, the author has made it an indispensable compendium of all the literature concerning the mural arts of the entire Anasazi area, from early to late. But though the scores of early accounts confirm the widespread incidence of mural painting, the material reported is rarely illustrated, and has been found in such fragmentary condition that it has added little of value to the study of aboriginal art. Thus it was not until 1935 that excavations by the University of New Mexico, the School of American Research, and the Museum of New Mexico in the pre-Spanish pueblo of Kuaua, in New Mexico, revealed the presence of twenty-nine successive coats of plaster on the walls of an abandoned kiva, seventeen of which bore elaborate mural decorations (still awaiting publication). There the techniques developed in removing layer after layer and in preserving and copying the decorations, showed the feasibility of recovering such treasures and stimulated the search for further finds.

The Peabody Museum, in 1936, made similar discoveries in its excavations at Awatovi and Kawaika-a, and starting with the technical advice made available by the archaeologists at Kuaua, the Peabody group eventually perfected a system, made necessary by new conditions encountered in the Hopi area. There in the course of four years' work seventeen kivas were uncovered from which an amazing total of 174 mural paintings were salvaged. In the long period since their abandonment, most of the kivas had filled with accretions from dumping or by natural hillside erosion. Under such conditions their plastered walls, originally some nine or ten feet in height, had all suffered from the effects of weathering so that the upper margins of the painted surfaces are missing, and gaps are common also in the more protected middle and lower sections of those best preserved. But in so large a group even the most fragmentary parts of paintings from badly deteriorated walls have added to an understanding of the decorative system as a whole. The patience and skill involved in the excavations are shown in one instance by the removal of one hundred successive layers of plaster from one wall, in the process of salvaging twenty-seven paintings. The artists had made use of as many as thirteen colors including black and white, of which six or more are usually found in each design. The murals are painted in two-dimensional style. Objects are represented in flat areas of color, each usually outlined with black, or occasionally with white or red. There is no attempt at modelling with light and shade, though rarely a blending of dark color at the edge of a lighter area is done very skillfully by spattering. In only one instance is there a representation of one object partly concealed by another.

The paintings are reproduced in figures 40 to 92. As a whole the collotype prints in varying shades of grey give a satisfactory realization of the actual colors but in a few instances certain minute details are lost to ordinary vision and need the aid of a magnifying glass, if the reader is to profit by the copious notes accompanying each figure. The volume is further enhanced by a group of nine plates of colorful serigraphs by Louie Ewing. These, preceding the collotype series, add greatly to the enjoyment and understanding of the latter. But since the page preceding the serigraphs affords ample space for further information the notes might better have included cross-references to the corresponding paintings in the collotype series, which would greatly facilitate comparison of the two modes of reproduction. One of the serigraph plates (I) is correctly designated as a composite of two sections of the corresponding collotype figure but in two others (D, F) obvious restorations should have been mentioned. Also supplementing the collotype series are twenty-four line-cut figures containing a total of over four hundred drawings of details.

These, mostly from the mural paintings, include also comparable details from ceramic and textile designs and other Pueblo source material, all well documented in the accompanying descriptive legends. The space devoted to such an exhaustive analysis is more than justified for the series will be of great value in various studies, not only of the Hopi, but of general Pueblo culture.

Leaving the attractive illustrations as a background, the reviewer now turns to Smith's text which deserves even greater space. Throughout its 363 pages, interspersed with maps, tables, and figures, he presents systematically every phase of his subject from kiva structure to the possible significance of the most problematical objects portrayed by the muralists. His detailed account of the various means employed in repair, removal, and copying of the paintings is in itself a veritable text book for all who may some day be faced (let us hope) with similar problems. Under the section, "Material Characteristics of the Wall Paintings," the investigation of materials and media employed by the mural artists has brought together much needed information, and particularly that under the head of Pigments. But here Smith is misled by conflicting statements concerning a commonly used ingredient in Pueblo ceramics, which he classifies as a black pigment. Briefly stated, the boiled, evaporated, and dried sap of beeweed (*Cleome serrulata*) does harden, like licorice, into a black cake. But when it is redissolved for use it varies, according to its density, from light to dark brown, and when applied to a clayey surface it dries as a slightly glossy, translucent brown. Thus its only use in mural painting would be as a "vehicle or binder" as described, pp. 30, 31.

In his analysis of layouts, patterns and design elements the author first assigns his material to four fairly distinct groups, ". . . without regard to time sequence, either known or imputed, but solely on the design features implicit within the paintings themselves." Under these categories he lists and discusses the structural characteristics peculiar to each, and also the objects portrayed. For instance, in Group I we find the extreme of static, bilateral symmetry, while II is characterized by dynamic unbalance. Of I the author says, p. 119:

> While there is often no close approach to actual detailed symmetry, there is apparent a very decided and consciously evolved intent to build up the design about a large central figure, and to arrange the minor figures and incidental details around it in such a manner that they will appear in compensation to each other at right and left of the central motive.

And of II he continues, p. 135:

> The static rigidity of Group I is quite lacking, and the larger figures, whether anthropomorphic or zoomorphic, are usually in a state of dynamic motion. The placidity and permanence of the figures of Group I, which give many of them the character of a tableau, are quite absent; on the contrary, in Group II the figures seem to be in vigorous movement, even though they may have been momentarily arrested like a moving picture film. Whereas the stories told by the Group I paintings are complete, those of the designs in Group II are, as it were, still in the process of development.

Foremost in human interest are the many remarkable anthropomorphs with elaborate ceremonial costumes and headdress. Next in importance are birds, mammals and other life forms, as well as ceremonial objects, among which stylized feathers abound. Following this comes a most searching presentation of the ceremonial significance of the material in which the author points out the many resemblances to the masked kachinas and unmasked personages surviving in the rituals of the Hopi and other pueblos of today. There follows also a well considered section on Symbolism with a discussion of many unwarranted interpretations associated with the term.

Finally in a comparative study of the paintings in relation to the ceramics of the Hopi and adjacent areas, Smith has gathered very convincing evidence of a parallel development in the design styles of the two media, the most spectacular of which is that of the Sikyatki and San Bernardo wares. This is further confirmed by tree-ring evidence covering much of the period from *circa* 1372 to 1630, the apparent date of abandonment of the latest kivas. But, though the mural art extended well into the post-Spanish period, it is purely aboriginal in content, without the slightest trace of European contact. In all, Watson Smith's work is an outstanding contribution to knowledge, not only of prehistoric mural painting as a craft, but also of the many interrelated phases of early Hopi culture, both material and nonmaterial, which the paintings faithfully record.

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The Coville Rock Shelter, Inyo County, California. CLEMENT W. MEIGHAN. Publications in Anthropological Records, Volume 12:5, University of California Press, Berkeley. 1952. pp. 171-215, 3 maps, 5 plates. $1.00.

The Coville rockshelter is in Death Valley National Monument, in the side of a small canyon in the Panamint Mountains "roughly halfway between Ubehebe Crater and Ubehebe Mountain" and about 150 feet above the canyon floor. The original limestone cave was about 45 feet across the face and 15 feet deep, but a fall of rocks from the roof before occupation began reduced the available area to about 15 feet at one end and 12 feet at the other. The excavation of the cave was carried out in June and July, 1951, as a cooperative project by the University of California and the National Park Service. The cave is dry and the preservation of materials is good. The entire deposit was removed by trowelling by 6 inch levels and screened through a ¼ inch mesh. A sterile 24 inch bottom layer was overlaid by occupation material mixed with rocks and dust. This was a few inches deep at the outer edge of the cave increasing to 40 inches at the rear.

After the usual introductory materials the report moves to a functional description of the artifacts. The

categories are: Domestic Utensils, Dress and Ornament, Hunting Tools, Ritual Objects, Miscellaneous and Unidentified. A section on Ecological Factors follows and then the Conclusion. Appendixes A-E give information on Minor Sites, Cordage, Mammal Remains, Plant Materials and Nonartifact Remains, and a Descriptive Table of Specimens. There is a bibliography, explanation of plates, and plates 25-29.

A total of 366 artifacts was recovered but they showed no change in type throughout the use of the cave. Of the total, 115 were basketry and 125 cordage. On the basis of the similarity of the artifacts to the ethnographic specimens from the region, the lack of "Caucasian materials" and some "degradation of the surface" of the site, the author assigns a tentative terminal date of A.D. 1750 for the cave. In view of the lack of change in the artifact types, a relatively short period of time is postulated for the use of the cave and an initial date of A.D. 1450 estimated.

> To sum up the statements presented this far, the Coville Rock Shelter shows some connections with the Southwest (slab-lined cists, two-rod-and-bundle coiling), a large number with the Great Basin, and virtually none with California. The culture may be defined as typically Great Basin of the protohistoric period, with slight evidence of some Southwestern connection. (p. 189)

In the areal and temporal comparisons the author is faced with a problem that is not of his making, namely the lack of knowledge of the depth perspective of the ethnographic horizons with which comparisons must be made, lack of archaeological data for comparison, and lack of actual and relative dates on the archaeological materials that are available. Another factor that complicates the problem of fixing the temporal and spatial relationships of the site is the marginal character of the cave and our lack of knowledge of the dynamics of the culture in this kind of a situation. Cross-dating, at best, is a tricky procedure that involves a lot of assumptions.

From an organizational point of view it would seem preferable to have put the section on ecological descriptions at the beginning of the study as a frame of reference rather than just before the conclusions. No vertical scale is shown on the profile, Map 3. A scale, such as a levelling rod, in the photograph of the profile, Plate 29L, would make the illustration more meaningful. A scale included in the photographs of artifacts rather than, as in this paper, a statement of size in the description of plates, facilitates the use of a publication. The use of the word "house-pit" to describe the occupational areas in the cave, when the author states that there is no evidence that there actually were house pits in the cave, leads to possible confusion in the use of this publication for distributional studies. The distribution of compound arrows (cane shaft and hardwood foreshaft) should have included the northern Great Basin in the area for these artifacts. Twined basketry on the basis of the pitch of the weft element has characteristic areas of distribution, an areal feature which could have been used to good effect in this study.

The author's handling of coiled basketry (Appendix E, Table 3, p. 209) is a confusion of the terms for weaving and coiling. He uses the terms weft and warp apparently for splint and foundation elements respectively. The words warp and weft apply to weaving in its different forms, a process that is entirely different from the sewing technique used in coiled basketry. An examination of Mason's classical work on *Aboriginal American Basketry* and Morris and Burgh's *Anasazi Basketry* would indicate quite clearly the terminology that is correct in each case. As the latter authors state, there is still some discrepancy in the terminology used in the description of basketry but the fundamental differences between the two basic kinds are well recognized. One wonders, then, why this confusion should appear in this study.

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NOTES AND NEWS

PLAINS

The Missouri Basin Project of the Smithsonian Institution operated on extremely restricted funds throughout the fiscal year July 1, 1953 to June 30, 1954. As a result of this limitation, very little field work was done in the summer of 1953 but a small amount is anticipated for the spring and early summer of 1954. A small amount of additional money was made available to the Smithsonian Institution by the National Park Service for emergency field work during the latter part of this period.

The Garrison Reservoir in west-central North Dakota has stepped up the flooding schedule to such an extent that some of the archaeological sites which were previously expected to be inundated late in 1954 or in 1955 now appear to be going under water as early as June 1954. This is especially unfortunate with respect to the site of Old Fort Berthold and the accompanying Indian village, Like-a-Fishhook, since they are of particular consequence to us and only a small part of the excavation necessary there has been accomplished to date.

At the time of writing the field plans for Garrison Reservoir call for the Smithsonian Institution to have a five to ten man crew under the direction of G. Hubert Smith in the field at the site of Old Fort Berthold and Like-a-Fishhook village from the first part of May until the end of June 1954. The State Historical Society of North Dakota, furthermore, will have a field party at that same site, investigating the earliest location of the historic fur-trading post (known as Fort Berthold I), under the direction of Alan Woolworth. This party will begin work sometime in May and carry on their excavations until the end of June or until the flood waters of Garrison Reservoir make further work impossible. Woolworth's party will also investigate the site of Kipp's fur-trading post which dates around 1823. The third objective will be to complete a brief excavation at the site of Grandmother's Lodge, also within the Garrison Reservoir flooding area. This latter project was started by the State Historical Society of North Dakota last season and represents perhaps one of the earliest earthlodges in this area.

The flooding of the Jamestown Reservoir in east-central North Dakota has also inundated archaeological sites earlier than had been anticipated. Consequently, the Smithsonian Institution will have a field party in the Jamestown Reservoir area at the Hintz site from sometime in May until the end of June. Investigations at this early protohistoric village site in 1952 provided a small amount of information on a previously unknown era in that section of North Dakota. The completion of the excavation here this spring will add greatly to the knowledge of the Jamestown Reservoir area at that particular time. The party completing the excavation at the Hintz site will then make a brief survey of the upper reaches of the Jamestown Reservoir. This region has not been previously reconnoitered for archaeological remains due to the urgency of getting some of the material excavated in the area further down stream, which was in more imminent danger of flooding.

The Smithsonian Institution will have a third field party completing the excavation at the Oldham site in the Fort Randall Reservoir, South Dakota from the middle of May until the end of June. Early in July this site will also be inundated by the water of the Fort Randall Reservoir. The party at the Oldham site will be under the direction of Robert B. Cumming, Jr., who handled the excavation at that site in 1951 and 1952.

The Smithsonian Institution will have a fourth party in the field in the Fort Randall Reservoir area in May and June of 1954. This party under the direction of Paul L. Cooper will be concerned with small-scale test excavations in 21 significant sites which will be flooded this summer by waters of the Fort Randall Reservoir.

The Nebraska State Historical Society will devote the entire summer to the excavation of the Crow Creek site, a large earthlodge village, in the Fort Randall Reservoir area near Chamberlain, South Dakota. This project is a cooperative one with the National Park Service and will be under the direction of Marvin F. Kivett. Kivett plans to be in the field excavating the site from early June until sometime in September. This is a large multicomponent earthlodge village that should provide a great deal of information concerning a number of archaeological manifestations in this particular area of South Dakota.

Under cooperative agreement with the National Park Service, the W. H. Over Museum-University of South Dakota and the South Dakota Archaeological Commission will spend approximately two months during the summer of 1954 excavating at the Swan Creek site. The field work will be under the direction of Wesley R. Hurt, Jr. This is the site of a large earthlodge village located in the Oahe Reservoir area north of Pierre, South Dakota. The village is significant particularly for the large accumulations of refuse and may have considerable bearing on the entire village sequence in the Oahe Reservoir area.

Carlyle S. Smith of the University of Kansas made a brief survey of sites along Walnut Creek and Pawnee River in Ness County, Kansas, in March 1954. Two village sites and a burial mound attributable to the Keith focus, a Woodland manifestation with Hopewellian affinities, were found. This extends the known distribution of mound building almost to the 100th meridian or over 80 miles farther west than previously known in the Central Plains. Smith will spend the summer preparing his report on the Talking Crow site for publication.

Regional Archaeologist Erik K. Reed and other National Park Service personnel have been occupied largely with problems of interpretation, miscellaneous routine business, and planning and coordination of the River Basin salvage program in Texas, Oklahoma, Arkansas, and Missouri; in the latter, the main recent activity

has been completion of reports on previous work by Edward B. Jelks at the River Basin Surveys field office, National Park Service, Austin, Texas.

Hugo Rodeck of the University of Colorado Museum will spend July with a small crew excavating in Little Box Elder cave in east central Wyoming. Previous excavations have yielded a Pleistocene fauna and some late superficial archaeological remains.

The Province of Saskatchewan is soon to have a new museum. On Jubilee Day, July 20, 1955, the Saskatchewan Museum of Natural History at Regina will be officially opened and dedicated to the pioneers of the province, an event marking fifty years in the Canadian Confederation.

NORTHERN MISSISSIPPI VALLEY

ILLINOIS. The Illinois State Museum is planning field work for the summer of 1954 in Hardin County, Illinois. A large campsite of the Archaic period has been chosen for excavation. Mealing stones, nutting stones, bannerstones and notched and stemmed projectile points have been found in quantities on the surface of the site. A mound, located near the campsite, will also be excavated to determine whether it is affiliated with the campsite. Field headquarters will be located in a two-story log house near the site.

The University of Illinois also plans to do archaeological field work in Illinois, as they have done every alternate year in the past. The area of the proposed work is in the Embarass River region which was surveyed two years ago by William Beeson for this purpose. This survey revealed interesting sites and materials representing new complexes and it is the object of the excavations to define and perhaps identify them. As in past years, McGregor plans to use student workers, giving them university credit as well as experience, and in some cases publishing their results. Six weeks will be spent in the field, and two additional weeks in the laboratory at Urbana working over, studying, and then preparing reports of phases of the work. Reports on previous work of the University of Illinois are moving very slowly toward completion.

INDIANA. Glenn A. Black reports that preparations are being made for another active season in the field. The Department of Anthropology, Indiana University, will again offer its field course in archaeology at Angel Mounds with the Indiana Historical Society as the sponsoring agency. The course offers ten hours of credit for the ten week session and emphasis, as usual, will be upon field methods and techniques.

The McKinley site, Hamilton, County, Indiana, will be excavated as a part of a two year undertaking at this site. J. C. Householder of Indianapolis and Downey Raibourn, graduate student in anthropology, Indiana University, will conduct the excavations.

James H. Kellar, graduate student in anthropology at Indiana University, will undertake the survey of another Indiana County. This is part of a long-term project started twenty-five years ago with the ultimate goal of a complete archaeological atlas for the state.

IOWA. Reynold J. Ruppé of the State University of Iowa reports that the Keyes collection, now housed at the Iowa State Historical Society in Iowa City, has been put in order for study through the courtesy of William J. Petersen, Director of the Society. The physical problem of storage with accessibility has been solved and the collection and notes are available for study. The collection is comprehensive and contains some excellent material. A preliminary inspection has revealed the presence of many archaic sites in Iowa, some of which produce such early pottery types as Fayette Thick. The most complete material is Glenwood, with Mills Creek material well represented. Wilfred Logan, archaeologist at Effigy Mounds National Monument, McGregor, Iowa, is in the process of studying the Woodland material of eastern Iowa.

Ruppé has assumed the editorship of the Journal of the Iowa Archaeological Society and hopes to have an issue ready in the near future.

MICHIGAN. Two members of the University of Michigan's Museum of Anthropology staff, James B. Griffin and E. F. Greenman, conducted studies in Europe during the year. Greenman devoted the fall term to inspecting museum collections and consulting European archaeologists. Griffin is spending a full year abroad with particular emphasis on northern Europe; he plans to return in August, 1954.

Summer plans for research at the Museum have not yet been completely formulated. However, the field school at Killarney, Ontario will be discontinued and the sites will be closed. Construction of a bridge at the Straits of Mackinac will probably involve archaeological salvage, and the University plans to conduct a survey of the area. Members of the Michigan Archaeological Society have also expressed interest in the salvage operation and undoubtedly will participate.

The annual meeting of the Michigan Archaeological Society was held in Ann Arbor on March 27. The membership indicated strong interest in founding a periodical and an opportune gift from one of the members will provide an initial fund for the purpose.

MISSOURI. Carl H. Chapman of the University of Missouri states that salvage archaeological work will be conducted on a partially destroyed mound located near Columbia which evidently contains a stone chamber on the interior. The party from the University and members of the state society will work under the direction of Robert T. Bray and Francis L. Stubbs. Excavation is continuing at Graham Cave and survey work is being initiated in the Norfolk Reservoir area and the Table Rock Reservoir area.

SOUTHEAST

KENTUCKY. W. S. Webb of the University of Kentucky, and R: S. Baby of the Ohio State Museum are preparing a revision of the Adena trait list. They have already turned up a fairly large number of new traits and have expanded the description of many others beyond the original Kentucky area, especially in Ohio.

TENNESSEE. T. M. N. Lewis, of the University of Tennessee, reports a trip into northern Alabama, March 12-13, checking paleo-Indian sites described by members of the Birmingham Chapter of the Tennessee Archaeological Society in recent issues of the *Tennessee Archaeologist*. Sites containing paleo-Indian components are surprisingly abundant. Although only three of the sites were visited, artifacts from at least fifteen others were examined. Archaic and Woodland components are usually present also on these sites, and a major objective of the trip was to learn if stratigraphic separation was possible on a site in Franklin County, Alabama.

The bulk of the artifact and midden material at this site was concentrated on a low rise of ground which local informants stated had been some five or six feet higher formerly. A test trench one meter wide was carried through a portion of this rise by a small group from the Birmingham Chapter under the supervision of Steve Wimberly and Lewis. Sterile subsoil was reached at about eighteen inches below the plow line, and very little of the deposit in the six meters of trench was free from burial and refuse pits originating in higher deposits which had been removed by bulldozer operations and cultivation. It was apparent that any further effort to search for visible stratigraphy at this particular site would be unproductive.

Lewis and Frank Soday of the Chemstrand Corporation of Decatur, Alabama, visited the highly productive "Quad" site near that city, from which Soday has collected a large quantity of paleo-Indian material during recent years. A preliminary report on this site is to appear in the forthcoming issue of the *Tennessee Archaeologist*. It is Soday's intention to carry a test trench through one of the four units of this extensive site later in the year.

GEORGIA. The manuscript of "The Excavation of the Funeral Mound, Ocmulgee National Monument, Georgia" by Charles Fairbanks has gone to the Government Printing Office at last. This reports the excavations of a temple mound with many burials carried out by A. R. Kelly some years ago. Future research at Ocmulgee National Monument will deal with the report of excavations in the vicinity of the Carolinian trading post.

FLORIDA. Ripley P. Bullen, Curator of Social Sciences, Florida State Museum, spent four weeks in February and March excavating near Charlotte Harbor on land owned by William H. and Alfred Vanderbilt. Five sites were extensively tested resulting in the uncovering of pottery and shell tools. Large sites were found to have been occupied over various archaeological periods.

John W. Griffin, Acting Assistant Professor, is leaving Florida State University, May 31. He will join the staff of the St. Augustine Historical Society, carrying out historical and archaeological duties.

University of Florida activities have been limited to a continuation of survey work on the Gulf Coast and excavations in the Dominican Republic (see West Indies).

The University Museum of Florida State University has received as a gift from Mr. Ivan Gundrum of Havana, Cuba, a large collection of reproductions of Antillean artifacts. Among the 350 specimens are very exact reproductions of many well-known pieces, the originals of which are scattered in many museums. The collection provides an excellent group of materials for study and exhibit, and a special exhibit is planned for next fall.

The Department of Anthropology and Archeology of the Florida State University is co-sponsoring the Zundapp Mid-America Expedition. H. Morgan Smith and Robin Mills, both graduates of FSU, are traveling by motorcycle from the United States to Panama, and are engaging in archaeological and ethnobotanical research along the way.

WEST INDIES

The Institute of Jamaica is conducting excavations at the site of Seville la Nueva under the direction of C. S. Cotter. This site dating approximately 1510-1540 was the major Spanish town in the island until its abandonment for a south coast capitol.

The accidental discovery of an unusual series of Spanish Gothic-style carvings several years ago brought the site to modern attention. Present work centers around the brick well where the former finds were made. To date it has revealed more bas-relief carvings belonging to the previous group and a large dog-like (?) figure, minus the head. Careful excavation is revealing an extensive architectural complex around the well—a courtyard paved with tile and an extensive maze of walls.

Although 18th and 19th century English material overlies the site, considerable Spanish artifacts are found close to the floor level. Spanish potsherds include early Columbia Plain and Caparra Blue majolica, thin-walled olive jar, and honey-colored ware. Associated with this is Bani-like Indian pottery.

This is one of the more important Spanish colonial sites in the West Indies and it should yield much data of a kind not found elsewhere. The present work reflects a long interest in the site by C. Bernard Lewis, Director of the Institute of Jamaica, and C. S. Cotter.

In January and February, John M. and Marguerita K. Goggin, University of Florida, participated in a joint Universidad de Santo Domingo-Museo Nacional-University of Florida, stratigraphic excavation at the Convento de San Francisco, Ciudad Trujillo, Dominican Republic. The former institutions were represented by Ing. Emil de Boyrie Moya and Dr. Rafael Montas.

A 5 by 30 foot trench in a refuse deposit was excavated to bedrock at varying depths of 4½ to 7½ feet. It yielded the richest sample of Spanish Colonial material known from any site in the New World, and included Boca Chica style Indian pottery in the lowest levels. Artifacts include potsherds of majolica, delftware, oriental porcelain, Mexican Indian pottery, and various plain and glazed earthenwares; tiles; iron work, includ-

ing nails, knives, scissors, and many miscellaneous objects; bronzework such as thimbles, buckles, hinges, finger ring, etc.; numerous 16th century copper coins; much glassware of all periods including a chevron bead fragment; and miscellaneous worked bone, stone, and other materials.

The stratigraphy appears to be good, ranging from early in the 16th century to the 20th century. Material is now being studied at the University of Florida where it is being partially utilized in Goggin's forthcoming *Spanish Majolica in the New World*. A detailed site report will also be prepared.

En route home, the Goggins spent several days in Jamaica consulting with C. Bernard Lewis and C. S. Cotter on Spanish colonial archaeology and studying the current excavations at Seville le Nueva.

PACIFIC COAST

In the Pacific Northwest, both the University of Washington and the University of Oregon have contracts with the National Park Service for archaeological salvage work in the Dalles Reservoir on the Columbia River. More evidence of early cultures is turning up in the Dalles Reservoir than was found in the McNary Reservoir farther up the Columbia.

National Park Service archaeologist Louis R. Caywood has completed a report on the 1951, 1952, and 1953 excavations at Fort Spokane, nine miles northwest of Spokane, Washington. His report covers the period from 1810 to 1826 when the Northwest Company (Canadian), the Pacific Fur Company (American), and the Hudson's Bay Company (British), occupied the site. A second section of the report describes Indian cultural remains found during the excavations of the forts. Caywood reports that Rex Butler has completed a study of the artifacts found at Fort Okanogan on the Columbia River near Brewster, Washington.

A symposium on archaeological sites in the Flathead Lake region, Montana, has been published by the Department of Sociology and Anthropology, Montana State University (Anthropology and Sociology Papers, No. 15, 1953). The included reports deal with pictograph panels, rockshelters, and occupation sites, and give evidence that the Flathead area was subject to strong influences from the Plains and the interior Plateau, and to a lesser degree from the Great Basin.

In the fall of 1953, Gillett Griswold and Dave Larom, under the direction of Carling Malouf of Montana State University, conducted a ten-day archaeological survey of the Hell Gate Canyon area, a 50-mile section of the Upper Clark Fork River. The party also sought out and examined artifact collections of residents of the area. Nine occupation sites were located by the survey party. Artifacts found included stone projectile points, knives, scrapers, mauls, pestles, and long cylindrical stones of undetermined function. This material corresponds closely with that of the Flathead Lake area, 75 miles to the northwest. A report on the survey is to appear in the April number of Montana State University's Anthropological Series.

Charles E. Borden of the University of British Columbia reports that he plans two surveys for June and July of 1954: one along lakes and streams in the Vanderhoof area in central British Columbia, and another in the Kootenay district in the southeastern corner of the Province. During August and September he intends to continue excavations at what appears to be the oldest habitation area on the Musqueam Reserve, Vancouver, B.C. This site is located on a bluff above the present historic village sites and seems to have been occupied before the lower areas, which are nearer the shore, were habitable. Surface finds on the bluff show a marked contrast to material from the recent sites and resemble in many ways the material from Marpole Eburne.

H. C. Taylor, Jr., and Western Washington College of Education students conducted archaeological reconnaissance and excavations on Lopez Island in the San Juan group last summer. Surveys and excavations on Vancouver Island are planned for summer and fall of 1954.

Richard D. Daugherty of the State College of Washington is in the process of compiling a report on last summer's excavations at McGregor cave, located on the Palouse River in southeastern Washington. An archaeological survey for the purpose of locating early sites in the Columbia Intermontane province is planned for this summer.

During its 1954 field session the University of Oregon will continue its 1953 excavations at the site east of Big Eddy, approximately five miles east of The Dalles on the Columbia River. The excavations will be under the direction of Luther S. Cressman, and will be conducted in cooperation with the National Park Service. A section of the site is stratified as follows: an occupation level just over two meters in depth resting on what appears to be river-laid sand, on this a culture-bearing layer of hardpan over one meter thick, and an uppermost occupation stratum about two meters thick. In the lowest occupation level under the hardpan are great numbers of partially mineralized fish, bird, and mammal bones. The artifacts from this level are generally similar to those of the two upper strata but are specifically different. No arrowpoints are identifiable in the 377 artifacts so far recovered, but spear or atlatl points appear to be included among them. Only a few of the smaller fragments (possibly points) show pressure flaking; all other blades and scrapers show only percussion. On the basis of the present evidence there seems to be no sharp cultural break, but certain changes are recognizable. Cressman hopes that work this summer will enable him to date the formation of the hardpan.

Jesse D. Jennings, University of Utah, indicates that a Great Basin Archaeological Conference, an informal working conference to bring together people actively engaged in western archaeology, has been organized. There is considerable interest and a strong support. The

meetings will be at Globe, Arizona, August 30 and 31, in conjunction (but in separate sessions) with the Pecos Conference meetings.

The University of California Archaeological Survey and Department of Anthropology are planning several archaeological projects for the summer. These include the continued examination of the ancient basalt implement complex of the Sierra Nevada Mountains, Nevada County; excavation of selected sites in the Tule Lake area, Modoc County; salvage excavation in the Monticello Reservoir area, Napa County; and survey and excavation in the Yosemite National Park region. The last two projects will be financed by the National Park Service.

C. W. Meighan reports a number of archaeological projects under way or anticipated by the Department of Anthropology, University of California at Los Angeles. A ten-man class in archaeological field methods has been working at a site near Tarzana. The site has yielded crude stone tools and a feature consisting of broken steatite bowls.

The survey and excavation of sites on Santa Catalina Island is proceeding with the sampling of several midden locations. Seve al steatite quarries used for the manufacture of large ollas have been mapped and photographed.

The excavation of two caves near China Lake, Kern County, is scheduled for April under the direction of M. Kowta, graduate student. One cave has yielded a quantity of basket fragments and other perishable artifacts.

Excavation of a large pottery-bearing site in northern San Diego County is also projected for April under the direction of Mildred Wissler, graduate student. This project is aimed at clarifying the protohistoric period in this area.

The University of California at Los Angeles field school in archaeology will spend the first summer session (June 21- July 31) at Cedar City, Utah in excavation of nearby sites. The College of Southern Utah is acting as host institution for the field program.

A field class of sixteen students from the University of Southern California has been excavating a campsite in Little Sycamore Canyon, Ventura County. The class was under the direction of William J. Wallace. This is the fourth site to be excavated in the canyon. Artifacts are few in number and appear to date from the pre-Canalino period.

Gerald A. Smith of the San Bernardino Historical Society has been conducting excavations in a cave near Daggett in the Mojave Desert. Several heavy dart foreshafts, large dart points, and cane shafts were recovered from the surface of the cave. The Archaeological Survey Association of Southern California is cooperating in the excavation.

SOUTHWEST

Four southwestern institutions undertook winter excavation projects, the most extensive of which was that of the Amerind Foundation. Under the direction of Charles Di Peso, assisted by Barton Wright, work began in September at the Paloparado site and continued into May. This was the second season at the Paloparado site, which dates from the Pioneer stage of the Hohokam into the historic period. Robert C. Euler of the Museum of Northern Arizona spent a week in the field in January concluding excavation of Antelope Cave, a Developmental Pueblo site in the Arizona Strip, north of the Grand Canyon. Joe Ben Wheat of the University of Colorado spent a week in April doing salvage archaeology on a Basketmaker III site in southwestern Colorado. The excavation of a triple-walled structure in Aztec Ruins National Monument, mentioned in July, 1953, "Notes and News," was undertaken last summer by T. B. Onstott, then of the National Park Service. Further work in connection with stabilization during the fall by Gordon R. Vivian revealed earlier P III structures underlying it. Mr. Vivian also completed the excavation and stabilization of Kin Kletso in Chaco Canyon National Monument.

Other Southwesternists spent the winter, and plan to spend the summer, in routine duties and the preparation of reports on past excavations. The National Park Service personnel has completed reports on the following: Archaeological work in Zion National Park done twenty years ago by Ben Wetherill, prepared for publication by Albert Schroeder; Gran Quivera by Gordon Vivian; Tonto National Monument by Charlie R. Steen and Lloyd M. Pierson; and a survey of the Otowi section of Bandelier National Monument by John M. Turney. Steen is working on materials from 1949-50 excavations in Canyon de Chelly. Marie Wormington of the Denver Museum of Natural History, Stanley Stubbs and Fred Wendorf of the Museum of New Mexico, Robert C. Euler of the Museum of Northern Arizona, and E. W. Haury of the University of Arizona report that they will not do field work this summer, but will catch up on reports of past digs.

Three Summer Field Schools will be held: Texas Technological College school will again be at the Bonnell site, New Mexico, from mid-July to late August. The site is on the Roswell-Ruidosa highway, fourteen miles east of the latter town. Additional side expeditions are planned, and at least a week will be spent at Bloom Mound, Roswell. The ninth session of the University of Arizona's school at Point of Pines will be under Acting Director Edward B. Danson. Ray Thompson of the University of Kentucky will be dig foreman. Excavations will be undertaken in the burnt room section of the large pueblo and in a nearby site which may fill the gap in the knowledge of the Point of Pines area between A.D. 600 and 1000. The seventh field session of the University of Colorado will be held at Mesa Verde National Park from July 22 to August 24.

Richard B. Woodbury of Columbia University, assited by some students, will be at El Morro National Monument, New Mexico, during the summer, making test excavations in the large late-prehistoric Zuni ruin atop the mesa.

Henry A. Carey of Moorehead State College, Kentucky, who spent the summer of 1953 investigating the Chihuahua culture, will return to study mounds in the Casas Grandes Valley and other localities in Grant and Hidalgo counties, New Mexico, where Chihuahua culture appears mixed with other Southwestern complexes.

Douglas Schwartz, sponsored by the Department of Anthropology and Peabody Museum of Yale University, will continue his work in Arizona begun last year. His objective is to determine the relationship between the prehistoric Cohonina and the historic Havasupai, by making a survey of Cataract Canyon, which is virtually unknown archaeologically, and by excavating caves used by the Supai to escape flood waters and as defensive dwelling sites to escape enemy raids. His field work began in March and will continue until September.

The Denver Museum of Natural History will soon publish the first of a new series of Proceedings on, "A Reappraisal of the Fremont Culture and the Northern Periphery," by H. M. Wormington. Miss Wormington is also starting work on a revision of her book, "Ancient Man in North America." The new hall in the Denver Museum, which will depict the prehistoric peoples of the Americas will be opened in a few months.

The Pecos Conference, annual gathering of Southwesternists, will be held at Gila Pueblo, headquarters of the Southwestern National Monuments, Globe, Arizona, on August 30 and 31 and September 1, 1954. Dale S. King is chairman of the interim committee, and Richard Woodbury and Ernst Antevs are members.

George E. Fay, of Joplin, Missouri, was the recipient of research grants from the American Philosophical Society and the Kansas Academy of Science, for an archaeological expedition to Sonora, Mexico. The research project included an archaeological survey, principally of southern Sonora (Hermosillo to Sinaloa), with a brief foray into northern Sinaloa.

The primary objective of the field trip was to locate prehistoric and historic village sites in a relatively unknown area, in an attempt to correlate northwestern Mexican Indian history with the Southwest. Fay was assisted by William Young (former University of Michigan colleague), now teaching high school history in Hyde Park, New York.

Approximately 150 archaeological sites were located, with specimens being collected on 110 sites. The cultural remains have been tentatively associated with recent and old Seri Indian occupations, Mayo and Yaqui Indians, and several culturally unidentified shell mounds and midden localities. The most important discovery was a prepottery lithic complex, west of Hermosillo, which very closely resembles Cochise material (San Pedro Stage) from southeastern Arizona.

Specific areas investigated included (1) West of Hermosillo to the Gulf of California, (2) Guaymas, Empalme, Cochorit, (3) Huatabampo-Yavaros, (4) Agiabampo, (5) Topolobampo, in Sonora, plus several scattered minor localities.

The collections when reported upon will be housed in the State Museum in Hermosillo.

The survey was conducted during the months of July and August, 1953. The investigation was originally contracted with the National Museum of Anthropology and History, Mexico City, but the writer was unable to carry out the survey until 1953.

SOUTH AMERICA

PERU. The January, 1954, issue of this journal carried an account of the work of the Inca Highway Expedition between March and August, 1953, during which period the expedition members did a reconnaissance of the Peruvian coast road and followed the highland road from Lake Titicaca to Curahuasi, west of Cuzco. Victor W. Von Hagen, director of the project, reports that exploration of the highland road continued until the expedition had reached Lake Junín in central Peru. The approach of the rainy season led the party to shift its attention to the coast in early November, and headquarters were established at Ica.

The highland road being followed is the main Inca highway which connected Cuzco and Quito. Von Hagen says that beyond Abancay the road could be traced almost continuously. It crossed the Pachachaca, not at the colonial bridge but farther down river where the remains of an Inca bridge can still be seen in line with the Inca tambo or way station of Cochacajas. This tambo is near a lake and is visible from the modern highway, though at some distance. Beyond Cochacajas the Inca road ran to a tambo at Huancarama, and then to Curamba, where there are imposing Inca ruins illustrated a century ago by Castelnau but never studied. The road dips down into Pincos, rises again through this valley, and skirts the Laguna de Pacucha, where there are more ruins. The tambo in the Andahuaylas valley was at Talavera rather than at Andahuaylas itself. Over the next divide, the road runs to Uranmarca, where there are ruins of a large town, and then descends some five miles to the Pampas River (formerly called River of Vilcas). The west bank tower of the Inca suspension bridge is preserved here. Above the bridge the road climbs almost vertically for 2,000 feet and runs to the major Inca site of Vilcashuaman, where there are abundant ruins of good Inca masonry and late Inca sherds everywhere. Since there was no accurate plan of the ruins of this site, the expedition took time to survey it.

Northwest of Vilcas is the former Jesuit estate of Pomacocha on the bank of the Vischongo River. The buildings here are entirely constructed of Inca cut stone blocks. An Inca ceremonial road 8 meters wide leads up the hill from Jesuit Pomacocha about three miles to a lake where there are some of the most

majestic ruins outside of the Cuzco area. The lake is partly artificial, about a kilometer long, and lies in the crater of an extinct volcano. Curiously enough, no potsherds were found at the Pomacocha site. The expedition made a plan of these ruins also. To the best of the Assistant Editor's knowledge, this site has never before been reported.

The main road goes on to Alpachaca and Chupas, passes near Quinua in the Ayacucho area, and crosses the Huarpa River to the Mantaro near Mayoc. Here the road splits, one branch following the heights north of the Mantaro and the other the heights south of the river. The north branch being the least known, a special effort was made to follow it. Luís Bendezú, a Peruvian member of the expedition, undertook this task, picking up traces of the road near Churcampa and following it nearly to Marcavalle where it rejoined the southern branch. These roads are 5 meters wide, the standard width in the mountains, and are unpaved but have the edges lined with stones. Steps are provided on steep slopes.

From Marcavalle the Inca road continued up the Mantaro Valley to Jauja, where there are abundant Inca ruins. The way station was probably at the modern railroad station of Tambo. Nearby are the remains of an Inca bridge over which passed an important lateral to Huarochirí and Pachacamac. Luís Bendezú was commissioned to explore this branch road and succeeded in following it from the tambo of Huarochirí up to the divide at Pariacaca.

North of Jauja the expedition picked up an Inca road 12 meters wide near Marco, at the base of the hill on which the great site of Tunanmarca stands. This road heads north, opening out to 15 meters wide on the puna; it goes over the pass of Inca-catuna, keeps to the east of the Junín River, and heads for Tambo del Sol on the north side of the Lake of Junín. This road Von Hagen calls the Military Road, largely because of its unusual width.

There is a fork in the road near Tunanmarca, and a branch which Von Hagen calls the Commercial Road heads off to the northwest. It narrows to a width of 8 meters and runs along the high puna east of Oroya, on the west side of the Junín River, and around the west side of Lake Junín. The part along the lake shore is paved, being the first paved Inca road the expedition has found in the sierra. A number of stone bridges were studied in this section. The Commercial Road leads to the great site of Bombon northwest of the lake.

Von Hagen's expedition has made an important contribution by identifying the site of Bombon, the precise location of which has long been debated by armchair students of historical geography. It is an immense site and a major road junction lying at the very head of the Mantaro gorge. Curiously enough, four photographs of this site, taken by W. V. Alford, were published in 1931 by P. A. Means (*Ancient Civilizations of the Andes*, figs. 139-142). Means, who had not visited the site personally, misidentified it as Pumatampu, a place mentioned by Garcilaso in discussing a region over 350 miles to the southeast. The site of Bombon has been seriously damaged through being used as a quarry for the construction of a modern dam across the Mantaro River. Von Hagen estimates that the site had at least 2,000 houses.

It was possible to identify a number of relay stations of the Inca post system along the Military Road between Jauja and Tambo del Sol, the first so identified in the course of the work. There is one called Mesapata, from which ten miles or more of the road can be seen. On each side of the road is a raised platform, 1 to 2 meters high and about 10 meters square, with steps leading up to it. Between these two platforms, in the middle of the road, is a round structure four meters in circumference. Forty meters away is a large tambo. Two miles farther on is the next station, at Inca-catuna. At San Cristóbal, near Junín, is a relay station on a hill, consisting of a platform about 8 meters square with a small building 4 meters square on top of it. At Canchis-chaca near Cahuarmayo is a fourth station, where the platform takes up part of the width of the roadway.

The success of the expedition in finding the physical remains of the Inca road system continues to be impressive, and it is clear that the road survey will lead to the identification of most of the great sites of the late period, throwing much valuable light on Inca patterns of settlement.

Miss Heath MacBain, a graduate student at Columbia University, had an opportunity to make a brief reconnaissance in the high sierra between Arequipa and Lake Titicaca while visiting mining camps of the Northern Peru Mining and Smelting Co. in the summer of 1953. The area is a barren puna at an altitude of about 14,800 feet, visited now only by miners and an occasional alpaca herder. Yet remains of earlier occupation are fairly common, consisting of field-stone alignments, chips and chipped implements of jasper and obsidian, and potsherds. Around the mining camp of Patillani (lat. 15° 35.74′ S., long. 71° E.) for example, Miss MacBain reports stone alignments on six of the highest hills including Cerro Antaña (15,452 feet). These alignments meander snake-fashion across the tops of the hills, from nowhere to nowhere. They consist of a single row of stones, collected nearby, of such a size that the stones stand not over a foot above the surface. They are old, ragged, and partly covered by windblown dirt. On five of the hills there is a pair of these alignments crossing one another. Neither the local miners nor anyone else has suggested a reasonable explanation for these stone features. Most of the hills are also crowned with piles of stones serving as windbreaks.

Jasper and obsidian flakes are abundant near the mining camp, and Miss MacBain collected one whole and one broken obsidian point from the surface. Surface sherds are of three types: a plain redware which is contemporary; green glazed ware, probably colonial; and

rare plain sherds of a darker red which may be ancient. All remains are on the surface; there is no depth of refuse.

Two features of these remains are of some special interest. One is the extraordinarily high altitude and barren nature of the area where they are found. The other is the occurrence of a chipped stone industry. In the neighboring Lake Titicaca basin, chipped stone is very rare except in quite early sites.

ARCTIC

Ivar Skarland plans to continue the Susitna River survey that he began with William Irving last summer for the University of Alaska. James W. Van Stone expects to dig in the Copper River area around Chitina. William Irving, who is now at Harvard, has received a grant from the American Academy of Arts and Sciences towards searching for "Eskimo and pre-Eskimo remains in the western Brooks range of northern Alaska."

Henry B. Collins writes as follows: "During the coming summer I plan to excavate on Southampton Island in Hudson Bay. I will be accompanied by William E. Taylor, Jr., J. Norman Emerson, and Eugene Ostroff, and the work will be sponsored jointly by the Smithsonian Institution, National Museum of Canada and National Geographic Society. We will work mainly at Native Point (Tunirmiut) 40 miles down the coast from Coral Harbour. This now abandoned site is the village where the last of the Sadlermiut died out in 1902-03. W. D. Bell, archaeologist on J. Brian Bird's geographical survey party in 1950, reports the presence of 75 old house ruins at Native Point, making it one of the largest old Eskimo sites in the central Arctic. There is also a separate Dorset site and many old graves. Our principal objectives will be to determine the relationship of the Sadlermiuts to the Thule and perhaps Dorset cultures; the relationship of Dorset and Thule in this area; and to collect skeletal material that may show the physical relationship of the Sadlermiut and Thule peoples. Our greatest hope, perhaps, is that we may find Dorset skeletons that would reveal the physical type associated with this early Arctic culture, one of the greatest desiderata of Eskimo anthropology today. We plan to hire an Eskimo boat to explore the adjacent coast line and also if possible Coats Island where Dorset sites are known to occur."

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